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AUTHOR Williams, Mary Louise; Mowry, George  
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## ABSTRACT

This interdisciplinary five-day unit provides students with an understanding of the issues in the debate on global climate change. Introductory lessons enhance understanding of the "greenhouse gases" and their sources with possible global effects of climate change. Students then roleplay negotiators from 10 nations in a simulation of the International Negotiating Committee (INC) for a Framework Convention on Climate Change, as a part of the United Nations Intergovernmental Panel on Climate Change (IPCC). Students explore the possible areas where agreements could be the basis for the writing of a global treaty to stabilize or reduce greenhouse gases. The postscript and update sections explain the scientific research that led to the IPCC Summary as reported to the global community December 1995. Attachments provide all necessary student materials including: (1) "Getting to Know Your Nation"; (2) "Comparative Data for Nations" (table); (3) "Background Information on Global Climate Change"; (4) "Sources of Greenhouse Gases from Human Activity" (table); (5) "Global Climate Change--Accountability by Nation"; (6) "Simulation: The Intergovernmental Negotiating Committee"; (7) "Negotiating Positions"; and (8) "Postscript and Update." (EH)

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# GLOBAL RESPONSES to POTENTIAL CLIMATE CHANGE:

## A Simulation



## PROJECT CROSSROADS

110 Vuelta Montuoso  
Santa Fe, New Mexico  
87501

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## GLOBAL RESPONSES to CLIMATE CHANGE: A Simulation

**Unit Overview:** In December 1995, the United Nations Intergovernmental Panel on Climate Change (IPCC) issued its report that officially recognized an increase in the global average temperature of 0.3°-0.6°C over the last century. This increase, according to the IPCC, was "unlikely to be entirely due to natural causes" and that "a pattern of climatic responses" due to human activities could be identified. This interdisciplinary, five-day unit provides students with an understanding of the issues in the debate on global climate change.

**Introductory lessons** enhance understanding of the 'greenhouse gases' and their sources, as well as possible global effects of climate change. With this information, students then role-play negotiators from ten nations in a **simulation** of the International Negotiating Committee (INC) for a Framework Convention on Climate Change. The INC is a part of the United Nations Intergovernmental Panel on Climate Change (IPCC). Students explore the possible areas where agreements could be the basis for the writing of a global treaty to stabilize or reduce the greenhouse gases. Based on the actual Convention adopted at the United Nations Earth Summit held in Rio de Janeiro, Brazil, in June 1992, the negotiating process teaches the students about the difficulties inherent in reaching a world-wide agreement. It also teaches about the vision that many nations share of a more sustainable world society. The **Postscript and Update** explains the scientific research that led to the IPCC Summary as reported to the global community December 1995.

**Objectives:** Students will be able to:

1. explain concepts important to understanding global climate change.
2. identify causes and potential effects of climate change.
3. determine the role of specific nations as sources of the problems and the solutions.
4. analyze the negotiating process and the potential success of a global climate treaty.
5. evaluate the individual's role in the global community.

**Time:** Five to six class periods

**Materials:**

Timers (You will need **three timers** or **one timer** that can be set for at least three different times.

*The timers represent 'doubling time' of populations. See pg. iii)*

Attachment 1A- Getting to Know Your Nation

Attachment 1B- (Table 1) Comparative Data for the Nations

Attachment 2 - Background Information - Global Climate Change

Attachment 3A- (Table 2) - Sources of Greenhouse Gases from Human Activity

Attachment 3B- Global Climate Change - Accountability

Attachment 4 - Simulation - Negotiating a Treaty

Attachment 5 - Postscript and Update

**Procedure:**

1. **Before class:** Duplicate for all students Attachments 1B, 2, 3A, and 5. Make copies for each nation of Attachments 1A, 3B and 4. Make transparencies, if desired, and signs with the names of the ten nations to be hung above or placed on the desks.

o Using **butcher paper**, make a large copy of Table 1, the Comparative Data Sheet, found on p. 11. Fill in all information columns **except** Population in Millions, Per Capita GDP, and Per Capita Energy Consumption. Leave these columns blank to be filled in during the game.

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- o **Prepare ten bags with contents described below.** *(These are only suggestions.)*
- o **Bags.** Medium size paper bags, zip-lock or plastic baggies can be used to hold the contents for the game. *[The contents will be (1) 8x5 population fold-out cards, (2) a bag of candy representing per capita GNP, and (3) 8x5 fold-out cards with pictures of lightbulbs representing per capita energy consumption. Project Crossroads uses cloth, draw-string bags because of long-term "wear and tear" usage.]*
- o **Population Fold-out Cards.** On 8x5 index cards draw or duplicate *(pattern found on p. xviii)* 10 or more figures *(each figure representing one million people)*. Use enough cards to represent the total population for each nation. The last card will have less than 10. *(For example, Bangladesh will have 11 cards with 10 figures on each for a total of 110 figures representing 110 million. However, the 12th or last card will have only 9.2 figures representing 9.2 million.)* Tape each end of the index card to the next, alternating front and back like an accordion. This will enable the population cards to be free standing or folded up. You will need to make duplicate sets for Bangladesh, Brazil, China, Nigeria and Saudi Arabia because of the short doubling time of their populations. When the timer goes off for each country, you will 'double' their populations. *(See p. iv)*

|              | Population<br>in Millions | No. of<br>Cards | No. of<br>Figures |
|--------------|---------------------------|-----------------|-------------------|
| Bangladesh   | 119.2                     | 12              | 119.2             |
| Brazil       | 157.8                     | 16              | 157.8             |
| China        | 1,218.8                   | 122             | 1,218.8           |
| Germany      | 81.7                      | 9               | 81.7              |
| Japan        | 125.2                     | 13              | 125.2             |
| Netherlands  | 15.5                      | 2               | 15.5              |
| Nigeria      | 101.2                     | 11              | 101.2             |
| Russia       | 147.5                     | 15              | 147.5             |
| Saudi Arabia | 18.5                      | 2               | 18.5              |
| USA          | 263.2                     | 27              | 263.2             |

- o **Bags of "Gold", Per Capita GNP/Standard of Living.** You will need plastic bags of hard candy or marbles representing per capita income *(each = \$150 per capita Gross National Product or GNP)*.

|              | Per Capita<br>GNP - 1993 (US\$)* | No. of Items<br>in bag |
|--------------|----------------------------------|------------------------|
| Bangladesh   | \$220                            | 1                      |
| Brazil       | \$3,020                          | 20                     |
| China        | \$490                            | 2                      |
| Germany      | \$23,560                         | 157                    |
| Japan        | \$31,450                         | 211                    |
| Netherlands  | \$20,710                         | 138                    |
| Nigeria      | \$320                            | 2                      |
| Russia       | \$2,350                          | 16                     |
| Saudi Arabia | \$7,780                          | 52                     |
| USA          | \$24,750                         | 165                    |

*\*These numbers are from the 1995 World Population Data Sheet, Population Reference Bureau.*

o **Per Capita Energy Consumption.** You will need to duplicate the pictures of Lightbulbs found on pp. xviii and xix. Tape the bulbs to a piece of cardboard to represent per capita energy consumption. Each metric ton = 2,204 lbs. or 1000 kilograms. 1 kilogram = 2.2 lbs. (Each bulb = 1 metric ton or 2,204 lbs of coal equivalent).

|              | Per Capita Energy<br>Consumption 1994<br>(metric tons coal equiv.) | No. of bulbs |
|--------------|--------------------------------------------------------------------|--------------|
| Bangladesh   | .2                                                                 | 1/5          |
| Brazil       | 1.24                                                               | 1 1/4        |
| China        | .9                                                                 | 4/5          |
| Germany      | 6.4                                                                | 6 2/5        |
| Japan        | 4.8                                                                | 4 4/5        |
| Netherlands  | 7.3                                                                | 7 1/3        |
| Nigeria      | .5                                                                 | 1/2          |
| Russia       | 6.5*                                                               | 6 1/2        |
| Saudi Arabia | 6.9                                                                | 6 9/10       |
| USA          | 11.0                                                               | 11           |

\*This number represents the per capita energy consumption for the former Soviet Union

2. **Day One of Class:** Divide the class into ten equal groups of 1 to 3 students (depending on class size). Hang the signs with the names of the nations above each group or place on the desks. Set timers as described below and on pg. iv.

|               |            |                      |
|---------------|------------|----------------------|
| Saudia Arabia | 22 minutes |                      |
| Nigeria       | 22 minutes | (Can use same timer) |
| Bangladesh    | 29 minutes |                      |
| Brazil        | 41 minutes |                      |
| China         | 62 minutes |                      |

Have ready a Transparency #1 with the unit objectives, a wall map of the world, and an outline of Attachment IB (pg. 11) written on the board or butcher paper. After the students have been assigned to and seated in their designated nations, announce to them:

*"We are beginning a unit on global climate change. You will be learning about 1) the sources of greenhouse gases in the atmosphere that cause global climate change, 2) the possible effects of global climate change, and 3) solutions that may slow the rate of change, and 4) actions that will move the world toward environmental and economic sustainability. Sustainability means finding ways for each generation to have a quality of life without destroying or using up the resources that are the means of providing some level of prosperity. It means living in such a way that we do not take away from future generations what they will need for their prosperity and progress. It means planning for the future and living in the present so that we consider our futures and that of our children and our children's children.*

*Why study about it? I, you, and your children will be living with the choices we make now. At present there is the opportunity to confront the problems with choices. But choices only exist if we understand the facts and the alternatives. To understand global climate change we will be engaging in a simulation on Day Three. You are sitting in groups which represent these nations - Bangladesh, Brazil, China, Germany, Japan, the Netherlands, Nigeria, the Russia Republic, Saudi Arabia, and the United States. But before we can begin the simulation, there are basic concepts that will aid us in understanding the reasons for greenhouse gases that cause global climate change."*

Hand each nation its appropriate bag along with Attachment 1A. (Attachment 1B - Comparative Data which is a summary of what will be introduced in the lesson and presented on the board or butcher paper will not be handed out until the conclusion of the game.) This data will be needed for later reference. Using the description in Getting To Know Your Nation, Attachment 1A, students from each nation will be asked to locate their nations on a world map and to present the facts underlined in Attachment 1A for the rest of the class.

Introduce the game by saying, *"What's In It For Me?" helps to clarify the concepts that aid in understanding basic causes of global climate change. The game will also give you a picture of your nation, and how it compares with others. First, read the information given in 'Getting to Know Your Nation.' Please have a member of your group stand up and present the facts underlined on the sheet and on the Comparative Data Sheet.* Except for the three columns which you will fill in, the information should already be on the butcher paper. As a member of each nation stands to present the facts which are underlined in Attachment 1A, you should locate the nation on the class map. Emphasize the sizes by contrasting both the square miles and the relative size. Continue to the next concept.

### Populations

*"What about Populations? Look in your bags and find your population Fold-out Cards. Keep in mind that each figure = 1 million people. As you tell us what your population is, please stand and hold up your cards so everyone can see. Then place them on your desks. Let's begin with Bangladesh."* Then continue on with each nation. Ask the students to keep the population cards sitting upright on the desks, if possible; this is important for the effect when the populations 'double'.

Population Density. Have the students refer to the Comparative Data for the Nations, Attachment 1-B. Next to the Population in Millions for 1995 is given the Population Density per Square Mile. Ask the students why this number is misleading. *(Populations tend to be unevenly concentrated in cities and regions where the land is more habitable. Ask the students how one figures this number? One divides the population by the square miles of land area.)*

Percent Urban. Once again refer to the Comparative Data chart. Ask the students what significance this number has? *% Urban helps explain why population density is not an accurate view of population distribution. In many nations populations tend to be concentrated in urban areas where the jobs are. It also helps to explain whether or not a nation is basically an agrarian - rural people.*

Population Doubling Time. Again referring to the Comparative Data chart, ask the students what does 'doubling time' mean? Of what importance is it to know the Population Doubling Time of a nation in terms of projecting population growth? *(Doubling time refers to rate of growth or increase of a population and the number of years it takes that country to double its population. If a country is growing at 0.5% per year its doubling time is 139 years, 1% is 70 years, 2% is 35, 3% is 23 years, 4% is 17.5 years. To figure out how long it will take a population to double in size, divide 70 by the growth rate.)*

When the first timer goes off, no matter where you are in the game, stop the game and announce, *"Saudi Arabia has just doubled its population. Each minute of this class period has represented one year in time; therefore, 22 minutes of this class has represented 22 years."* Give the Saudis another set of Population Fold-out Cards to put aside the other. Then announce the doubling of the populations of Nigeria (22 minutes), and Bangladesh (29 minutes). Then 'double' their populations by giving them a second set of cards. Ask the groups, *"What does this population growth mean to your governments and nations in terms of food, energy resources, and per capita income?"*

Continue the game until the timer goes off for Brazil (41 minutes) and 'double' its population. Toward the end of the period (62 minutes) and game, the last timer will go off for China. After you add China's second set of Population Fold-out Cards, ask if they see any correlation between per capita GNP, per capita energy consumption, and population growth? Ask what effect population growth has on the use of the world's resources?

**% Population Under Age 15.** Again referring to the chart ask the students why is it important to know what percentage of a nation's population is under 15? *(If 46% of the population is under 15%, it means this large young population will reproduce. Even if they have just two children, this age group will significantly increase the nation's population because of the sheer numbers who will and are reproducing. This results in an even faster doubling time. A rapidly growing population demands more food, energy, etc.)*

**Per Capita GNP/Standard of Living.** Have each nation pull from its bag its 'GNP', bags of candy, etc.. Each piece represents = \$150 per capita Gross National Product or GNP. *"GNP is the value of everything produced or sold in that country - here measured in U.S. dollars. Per capita GNP means the GNP divided by the population. Per capita GNP is an indicator of the standard of living of a nation. Each nation, as its population grows, consumes more and more resources to maintain or increase its per capita GNP or standard of living."*

**Per Capita Energy Consumption.** Have each nation pull from its bag the cards with the lightbulbs. Point out that, *"A metric ton = 2,204 lbs or 1000 kilograms. Each bulb = 1 metric ton of coal equivalent. Coal equivalent means the amount of energy one gets by burning a ton of coal. In order to achieve a high standard of living, high levels of energy consumption historically have been and are at present required. If the sources of energy are fossil fuels (coal, oil, etc.), one of the results has been an increase in the gases causing some global climate change as we shall see tomorrow."* At the end of the period, use TRANSPARENCY # 2 to conclude the lesson.

### 3. Day Two of Class:

Hand out Attachment 2, Background Information - Global Climate Change. Either use as the basis for a lecture or student reading to learn this material. Check for comprehension by discussing each major topic area using TRANSPARENCIES 3-7. Conclude with TRANSPARENCY 8.

### 4. Day Three of Class: BEGIN the SIMULATION of the UNITED NATIONS' INTERGOVERNMENTAL PANEL on CLIMATE CHANGE. Announce that this simulation is based on fact. The time is early 1992. The nations' negotiators are preparing for the Earth Summit to be held at Rio de Janeiro, Brazil, in June 1992. The following data was for the 1992 period. Updated information since the Rio conference is provided in the Postscript.

Hand out Attachment 3A, Table 2 - Sources of Greenhouse Gases from Human Activity and 3B Global Climate Change - Accountability. Have the students in their groups study Table 2 and begin analyzing and relating the sources on Table 2 to their national accountability or responsibility. Have each group (nation) prepare a 'statement of accountability' - what their nation has been doing to add to the greenhouse gas concentrations in the atmosphere - to be presented to the class.

As the negotiators from each nation give their presentations to the rest of the class, they should fill in their nation's rankings and be prepared to answer any questions on their accountability on either a transparency of 3A (Table 2) or a large piece of butcher paper with the same information written on it. Use as a review and an overview for the entire class of what each nation is adding to the accumulation of greenhouse gases.

5. **Day Four of Class: Hand out Attachment 4, Simulation - Negotiating a Treaty** to each nation. Go over the background issues and instructions for simulation on pp. 28-29. Follow the instructions under **AS MEMBERS OF YOUR NATION**. Each nation should write out its positions at the conclusion of the class period and determine what negotiator will be working on which issue(s) in preparation for the Negotiation Phase.
6. **Day Four or Five: NEGOTIATION PHASE:** Go over the instructions found on p. 29, AS Intergovernmental Negotiating Committee (I.N.C.) NEGOTIATORS. Set up the room with groups dealing with particular issue(s). Then give at least one period to working for an agreement. **Using a large piece of butcher paper** have the working negotiations summarize the issue and the agreement (if any) reached. At the end of the class period stop the negotiations. In the combined large group determine if there is enough agreement upon which to base a global climate change treaty.

As students negotiate, monitor their agreements to make sure they are 1) addressing the issues, 2) thinking about **sustainable development**, 4) slowing the rate of increase of greenhouse gases in the atmosphere, and 5) working toward global agreements.

7. **Day Five or Six of Class:** If further time for negotiation is desirable, allow an additional 15 minutes. But, leave sufficient time for debriefing. **Hand out Attachment 5, the Postscript**. Give time to read it and ask for comments and ideas generated from the Postscript. Then, begin the debriefing.

**Debriefing the lesson** is one of the most important elements of the unit. It is a means of determining how much and at what level the students understand the material and of correcting any misconceptions or erroneous conclusions. It should be a large group activity. Use the following as a guide:

- 1) What is your reaction to the comments about the **role of the citizen in learning to ask 'the right questions of the experts'**? Should such problems as global climate change be left to the experts? Do they need citizen in-put?
- 2) We have studied the **problem of increased greenhouse gases leading to global climate change**. Do you feel you now have **enough understanding to follow this technical debate in the media**? From this unit, do you feel qualified to ask 'the right kinds of questions' of the experts?
- 3) The **role of population and standard of living** has been presented as major factors in increased greenhouse gases. Did you agree with this assessment or judgment?
- 4) How would you best describe the **process of negotiation** for solving global problems? What are the strengths and weaknesses of negotiation? What specific successes did your nations have with the process? Specific difficulties? (You may wish to have each nation respond to this question.)
- 5) If your nations were able to agree to a **global climate change treaty**, how would individual lives be affected in each of your nations? Would there necessarily be significant changes in standards of living? How could such a treaty be enforced? If some nations decide they cannot agree to such a treaty to prevent further atmospheric concentrations of greenhouse gases which cause climate change, what should other nations do?
- 6) Where does the individual fit into all of this? What should the **role of the individual** be?
- 7) What are the **most important concepts or impressions** you are left with having studied the sources of the greenhouse gases causing global climate change?
- 8) How do you think nations might be able to **move toward sustainable development**. What are the problems we might encounter?

## **MAJOR SOURCES USED IN THE PREPARATION OF THIS UNIT**

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## Getting To Know Your Nation - PEOPLE'S REPUBLIC OF BANGLADESH:

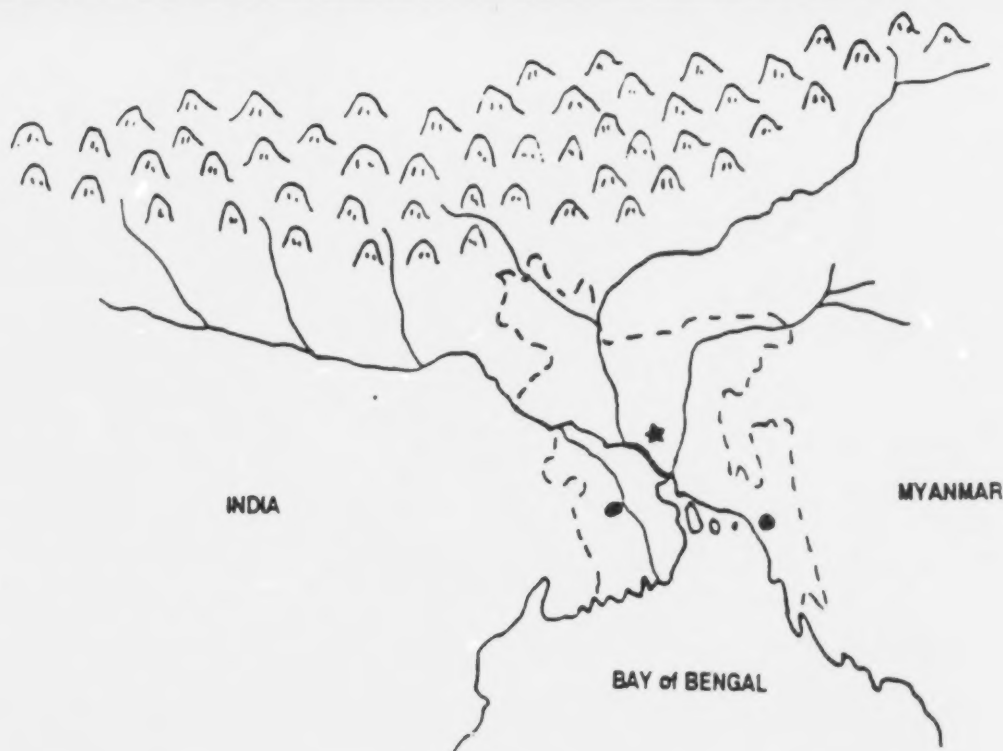
**Geography:** Located in southern Asia; surrounded by India with a small common border with Burma on southeast. Land area: slightly smaller than Wisconsin; mostly low plain cut by rivers and their deltas formed in and flowing from the Himalayas. The Ganges River flows from west and the Jamuna (Brahmaputra) from the northeast forming the Padma. Joined by the Meghna, the rivers empty into the Bay of Bengal. No part of the delta region is higher than 600' above sea level. Only hilly region is to the east. Climate is tropical monsoon, one of world's rainiest: approx. 50" in west, 100" southeast, 200" in northeast.

**Population:** Average of 4.9 children is down from the recent 6.7 children per family; the goal is to reach 2.3 children per family by the year 2000. One of the world's poorest and most densely populated. Ethnic groups: Bengali 98%, Bihari tribesmen. Life expectancy: 54. Literacy: 29%. Languages: Bengali (official) and English. Religion: 85% Muslim and 14% Hindu.

**Economy:** Underdeveloped. Labor Force: 70% agriculture (67% of the land arable); 19% services; 11% industry. Produces most of the world's output of jute (used to make rope and carpet backing). Foreign debt in U.S. dollars 9,330,000,000. 20% of what they produce goes to pay interest on this debt. Petroleum products: natural gas (200 year supply), off-shore oil in Bay of Bengal, coal reserves.

**Political Data:** Capital is Dhaka. A Moslem parliamentary republic under a President (head of state and figure head) and a prime minister (head of government). President and Parliament elected. President appoints Council of Ministers. Khaleda Zia, widow of assassinated President Ziaur Rahman, won the election in 1991.

**History:** Bangladesh was a part of the British colony of India. When India was promised its independence after World War II, rioting broke out among the religious groups - Hindus, Muslims and Sikhs. To resolve the religious strife, India was divided into two nations when independence came in 1947. India was mostly Hindu with a minority of Sikhs; Pakistan was Muslim. But Pakistan was a nation of two separate parts separated by 1000 miles of hostile Indian territory. After declaring independence from West Pakistan and fighting a brief civil war, East Pakistan became the independent Moslem country of Bangladesh meaning Bengal Nation. After much political instability, Bangladesh declared itself an Islamic Republic in 1988. It suffered terrible devastation from natural disasters in 1988 and 1989 because of flooding from monsoon rains. Some 4,000 died. Then in 1991 cyclones struck killing 125,000 more. Well over 30 million were left homeless from these disasters.



## Getting To Know Your Nation - FEDERATIVE REPUBLIC OF BRAZIL

**Geography:** Located in eastern half of South America. Atlantic Ocean on its 4,603 mile long eastern coastline. Land area: fifth largest country in the world occupying 48% of the South American continent. The topography of half the country is dominated by the Amazon River and its tributaries forming the heavily wooded Amazon basin; Climate varies from hot and wet in the tropical rain forest of the Amazon basin to temperate in central and southern grasslands.

**Population:** Most of the population is in the south-central and coastal regions; sparse population in vast rain forest. Ethnic groups: Majority are Portuguese, Africans and mulattoes. Life expectancy: 66; Literacy: 81%. Official language: Portuguese. Religion: 90% Roman Catholic.

**Economy:** Developing. Labor force: 40% services; 35% agricultural (67% arable land; 80% of land held by 5% of population); 25% industrial. Second largest exporter of agricultural products; leading producer of coffee. Manufactured goods account for over 50% of exports. World's largest tin mine; many mines of gold and other minerals; vast unexploited mineral reserves. Mostly hydro-generated electricity. Imported petroleum down due to manufacture of ethanol (derived from sugar and cassava root). One of the world's highest foreign debts - in U.S. dollars 89,841,000,000. 36% of what they produce goes toward paying the interest on this debt.

**Political Data:** Capital is Brasilia. A federal republic of 23 states, territories, and a Federal District (Brasilia). The government is made up of a president and a bicameral legislature (Chamber of Deputies and Senate). Had a military-backed government from 1964-85. Democracy has been reestablished. A new president was democratically elected in December 1989, but was forced to resign in late 1993 because of corruption charges.

**History:** Portugal claimed Brazil in 1500. Brazil became independent 1822, and a federal constitution was adopted in 1891. In an effort to develop the interior, the capital was moved from Rio de Janeiro to the new city of Brasilia in 1960. An agrarian land reform program in 1985 gave land to the landless in an attempt to lessen the effects of serious housing shortages, lack of healthcare and education, and high unemployment in the cities. But conflict has broken out between the Amazonian natives and the new landowners. Serious environmental impacts are threatening and destroying the Amazonian ecology; however, an environmental program was instituted in 1989 to begin to address concerns of the global community. The Amazon rain forest influences global weather patterns.



## Getting To Know Your Nation - PEOPLE'S REPUBLIC OF CHINA:

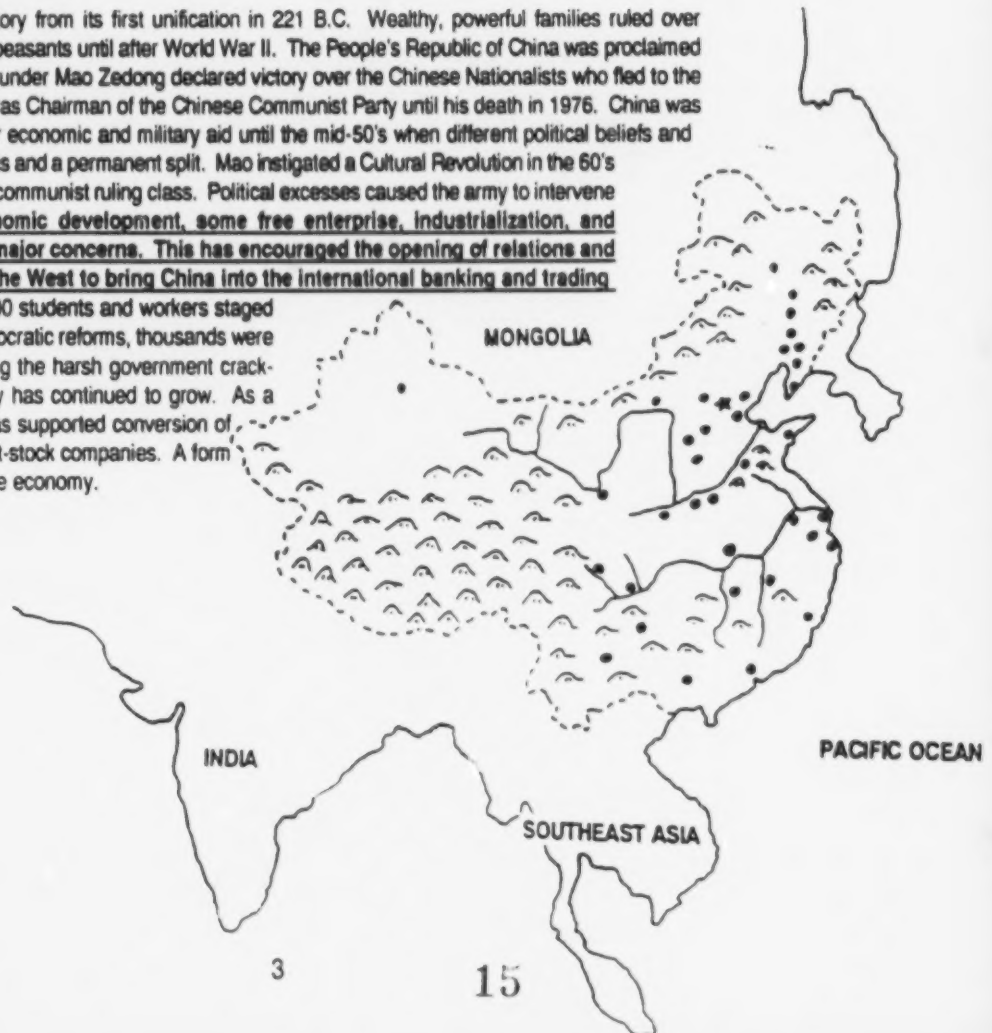
**Geography:** Located in north-central Asia. Land area: somewhat larger than the lower 48 states of U.S.; mountains and desert dominate two-thirds of the topography with only one-tenth in cultivation; three great river systems make the eastern half one of the most well-watered regions in the world. Climate ranges from sub-tropical in the far south to an annual average temperature in the north of 50 degrees F; rainfall varies from monsoons in eastern China to an arid northwest.

**Population:** One in every five people in the world is Chinese. China provides incentives to one-child families and penalties to three or more child-families. Based on data after a 1992 'birth-control crackdown', there is now an average of 1.8 or 1.9 children per Chinese woman, the same as in the U.S. or Britain. This statistical achievement was not expected for several years; however, it was accomplished by methods of coercion regarded in the West as extreme. Ethnic groups: Han Chinese 94%, Mongol, Korea, other. Life expectancy: 69 years. Literacy: 73%. Languages: Northern Chinese (Mandarin) with southern dialects and languages of various ethnic groups. Religions: Confucianism, Buddhism, Taoism, and Moslem and Christian minorities.

**Economy:** Developing. Labor Force: 60% agriculture and forestry (10% arable land); 25% industry and commerce. Largest producer of rice in the world. Foreign debt estimated in U.S. 32,196,000,000. Of the money earned from what they produce they are paying 6.9% of that in interest on that debt. Vast deposits of coal (16% of proved global coal reserves), and iron ore. Believed to have significant reserves of natural gas. Fossil fuels account for 95% of energy sources, but world's leading user of biologically derived methane gas.

**Political Data:** Capital is Beijing. The Communist Party governs the state through a President (head of state), a Premier (head of government), and the General Secretary of the Communist Party. The National People's Congress, consisting of 3,000 deputies, appoints the premier and other ministers.

**History:** China has a long history from its first unification in 221 B.C. Wealthy, powerful families ruled over dynasties of emperors and poor peasants until after World War II. The People's Republic of China was proclaimed in 1949 when Communist forces under Mao Zedong declared victory over the Chinese Nationalists who fled to the island of Taiwan. Mao Zedong was Chairman of the Chinese Communist Party until his death in 1976. China was dependent upon the U.S.S.R. for economic and military aid until the mid-50's when different political beliefs and border disputes produced tensions and a permanent split. Mao instigated a Cultural Revolution in the 60's to prevent an establishment of a communist ruling class. Political excesses caused the army to intervene and stop the revolution. Economic development, some free enterprise, industrialization, and population control have been major concerns. This has encouraged the opening of relations and joint economic ventures with the West to bring China into the international banking and trading communities. But when 100,000 students and workers staged protests in 1989 demanding democratic reforms, thousands were killed, injured and arrested during the harsh government crackdown. Since then, the economy has continued to grow. As a result, the Central Committee has supported conversion of state-owned enterprises into joint-stock companies. A form of capitalism has entered into the economy.



## Getting To Know Your Nation - FEDERAL REPUBLIC OF GERMANY

**Geography:** Located in central Europe. Land area: somewhat smaller than Montana; flat in the north, hilly in center and west but mountainous in the south. All major rivers which including the Rhine flow into the North Sea with the exception of the Danube which flows into the Black Sea.

**Population:** Ethnic groups: German 93%. Life expectancy: 76. Literacy: 99%. Languages: German. Religion: Protestant 49% and 45% Catholic.

**Economy:** Industrialized. Labor Force: 5% agricultural (35% arable land); 40% industrial & communication; 54% services. One of the world's strongest economies despite having to modernize the former East Germany. One of the world's largest exporters.

**Political Data:** Capital is Berlin. A federal republic with 16 states with substantial powers. The president is the head of state while the head of government is the chancellor. Upper house or Federal Council is the Bundesrat. Lower house or Federal Assembly is the Bundestag.

**History:** German tribes existed in the region well before the first century B.C. having fought Julius Caesar in 55 and 53 B.C. Charlemagne unified some of the regions which were later split apart again because of the religious wars of the 17th century. Bismarck accomplished unification of the German states in 1871 forming the German Empire which reached its peak as a colonial power in 1914. After the defeat of Germany in World War I, a republic was declared which existed until Hitler took power in 1933. Hitler waged a series of aggressive actions which ended in the devastating defeat of Germany in World War II. The victorious allies - Britain, France, U.S.A. and the U.S.S.R. - occupied Germany but could not agree on the ultimate fate of the German nation. Each created a government in its area of occupation and Germany became two separate nations for the next 45 years. Finally, in 1990 the 'Big Four' Allies as well as both Germanies reached an agreement on German reunification which took place that year. The new parliament, which included east Germany, convened in 1991. The cost of incorporating eastern Germany has been much larger than initially expected; this has caused increased tensions that have spilled over in the form of violence against foreign workers.



## Getting To Know Your Nation - JAPAN (NIPPON):

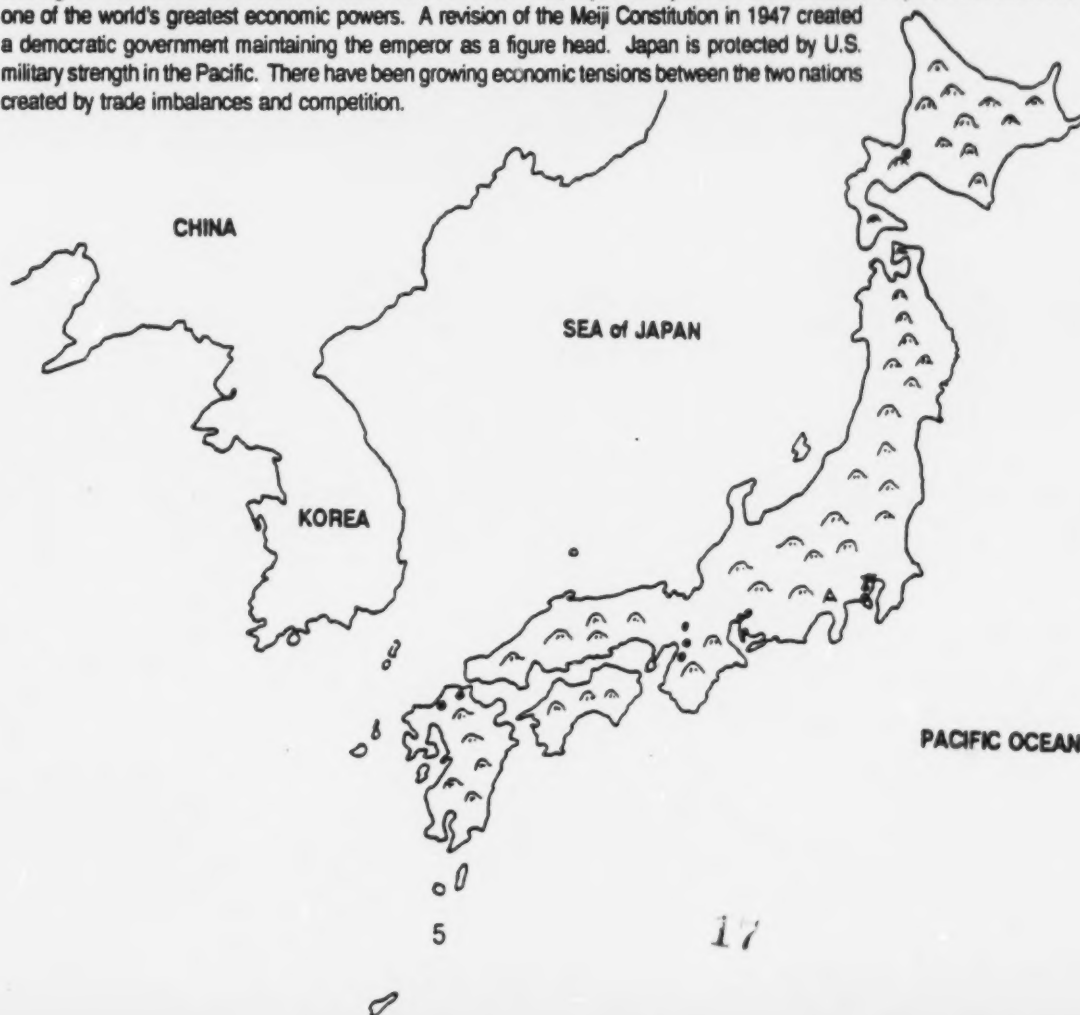
**Geography:** Located off the eastern coast of the continent of Asia. Land area: slightly smaller than California; mountains cover 71% of land surface; 29% plains located along seacoast. Consists of four major islands - Honshu, Hokkado, Kyushu, Shikoku - and thousands of small islands. Situated on the Circum-Pacific Ring of Fire; continuous earthquakes with average of 1,500 shocks/yr.; 30 active volcanoes. Climate is temperate with rainfall of 40-120".

**Population:** Population concentrated in the flat areas along the seacoast. Ethnic groups: Japanese 99.4%, Koreans 0.5%. Life expectancy: 79. Literacy: 99.9%. Language: Japanese. Religions: Buddhism, Shintoism, Christianity.

**Economy:** Industrialized. World's second largest economic power; one of the fastest growing economic systems in the world. Important in world trade. Of the world's 10 largest banks, 7 are Japanese. A technological leader in electronics, heavy industry, automobiles. Of the 100 largest companies, 53 are Japanese. Japan is now the largest contributor of financial aid to developing countries. Has had trade surpluses. Promoting nuclear energy for electrical generation.

**Political Data:** Capital is Tokyo. Parliamentary democracy with Emperor Akihito as head of state. The prime minister is head of government. The bicameral Diet (congress) has a House of Councilors and a House of Representatives. The Liberal Democratic Party controlled the government continuously until 1994 at which time a Socialist was elected prime minister.

**History:** According to Japanese mythology the origins of Japan are believed to be over 2600 years ago. In 1868 power was centralized by Emperor Meiji. He provided the first Japanese written constitution. Trade with the West began in the 16th and 17th centuries. Commodore Matthew C. Perry opened trade with the U.S. in 1854. As a result Japan began modernizing its military, educational system, and industries. Japan defeated both China and Russia in relatively short wars at the turn of the century. Japan then launched a series of aggressive actions in the next thirty years against Korea, China, and Southeast Asia ultimately leading to Pearl Harbor and defeat in World War II. After the war, Japan slowly rebuilt its industries and system of trade becoming one of the world's greatest economic powers. A revision of the Meiji Constitution in 1947 created a democratic government maintaining the emperor as a figure head. Japan is protected by U.S. military strength in the Pacific. There have been growing economic tensions between the two nations created by trade imbalances and competition.



## Getting To Know Your Nation - KINGDOM OF THE NETHERLANDS:

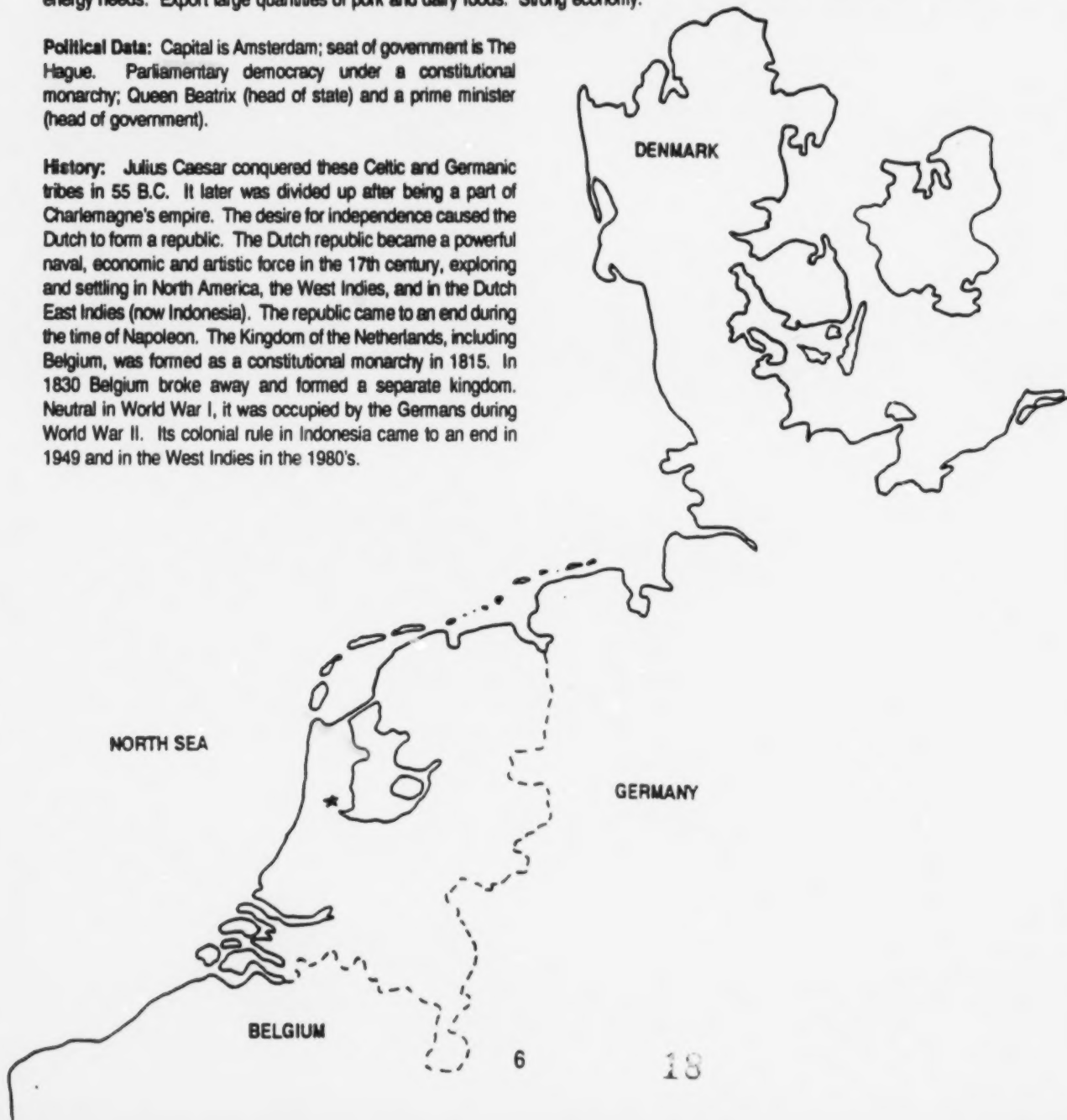
**Geography:** Located in northwestern Europe. Land area: same size as Mass., R.I. and Conn. combined; flatland with 27% of the land lying below sea level; average altitude of 37 ft. above sea level with reclaimed land below sea level (close to 500,000 acres) protected by 1,500 miles of dikes. Three topographic divisions - the dunes, the lowlands ("polders"- low-lying land reclaimed from the sea and lakes protected by dikes), and the higher eastern section of the country. Climate is cool, temperate maritime; average annual rainfall is 30".

**Population:** Ethnic groups: Dutch 97%. Life expectancy: 77. Literacy: 99%. Languages: Dutch. Religions: 36% Roman Catholic and 27% Dutch Reformed and Protestants.

**Economy:** Developed. Labor Force: 1% agriculture (25% arable land); 28.2% industry, commerce, and construction; 50.1% in services; 20% government. Oil refineries and chemical producers, natural gas and oil. Natural gas provides 1/2 of country's energy needs. Export large quantities of pork and dairy foods. Strong economy.

**Political Data:** Capital is Amsterdam; seat of government is The Hague. Parliamentary democracy under a constitutional monarchy; Queen Beatrix (head of state) and a prime minister (head of government).

**History:** Julius Caesar conquered these Celtic and Germanic tribes in 55 B.C. It later was divided up after being a part of Charlemagne's empire. The desire for independence caused the Dutch to form a republic. The Dutch republic became a powerful naval, economic and artistic force in the 17th century, exploring and settling in North America, the West Indies, and in the Dutch East Indies (now Indonesia). The republic came to an end during the time of Napoleon. The Kingdom of the Netherlands, including Belgium, was formed as a constitutional monarchy in 1815. In 1830 Belgium broke away and formed a separate kingdom. Neutral in World War I, it was occupied by the Germans during World War II. Its colonial rule in Indonesia came to an end in 1949 and in the West Indies in the 1980's.



## Getting To Know Your Nation - FEDERAL REPUBLIC OF NIGERIA:

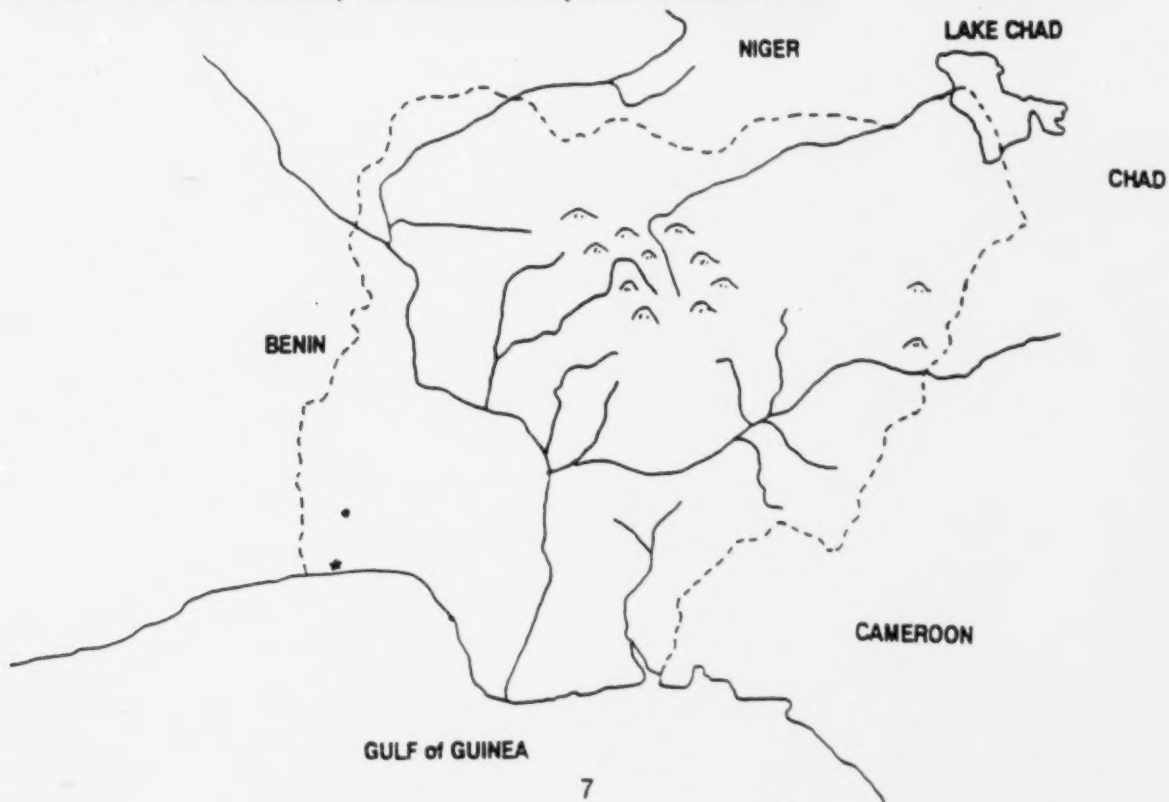
**Geography:** Located on the southern side of the western bulge of Africa; the Gulf of Guinea and the Atlantic Ocean are to the south. Land area: twice the size of California; varied topography dividing it into four east-west strips - the southern most strip is a coastal mangrove swamp, then tropical rain forest, a plateau of savanna and open woodland, and semidesert to the north. The great Niger River with its tributaries flows through much of the country and is joined by the Benue River on its journey to the Gulf of Guinea.

**Population:** Average number of children was 6.2 per woman in 1990 with goal of 4.0 in 2000. Ethnic groups: Hausa 21%, Yoruba 20%, Ibo 17%, and others. Life expectancy: 56 years. Literacy: 51%. Languages: English (official), tribal languages. Religion: 50% Muslim (in northern region of Hausaland), 40% Christian (in the south in the Yoruba region), and other religions.

**Economy:** Underdeveloped. Labor Force: 54% agriculture (31% arable land); 19% industry, commerce, and service; 15% in government. Crude oil makes up 95% of exports; Africa's leading petroleum-producing country. Foreign Debt in U.S. dollars - 34,089,000,000. To pay interest on this debt takes 34% of money earned from exports.

**Political Data:** Capital is Lagos. A military government. Senior officers make up the Armed Forces Ruling Council. They appoint the President and the National Council of Ministers. The government promised a return to civilian rule in 1992, but annulled the result of the June 1993 election and suspended the promise. In November, 1995, the military regime outraged the world when it executed an internationally esteemed human-rights activist, Ken Saro-Wiwa and eight others who campaigned against the environmental devastation of Nigeria's oil-producing region.

**History:** Earlier cultures date back to 700 B.C. The Yoruba States, along the northern regions of the tropical rain forest, and the Hausa States, in the northern plateau of savanna and woodland, were two of the great empires which flourished between the 10th and 16th centuries. One of the earliest towns was Ife, in the Yoruba region, which prospered and produced great works of art as early as the eleventh century. The northern regions became one of the largest Muslim states of the 19th century ending with the British invasion and colonization of Nigeria in the late 19th century. From the time slavery was legalized in the American colonies in 1650 until the importation of slaves was made illegal in 1808, many captured slaves came from the Yoruba region. Nigeria became independent in 1960 and a republic in 1963. A bitter civil war broke out in 1967 ending in 1970 with over a million casualties, mostly Ibos. Intermittent military rule has continued into 1996.



## Getting To Know Your Nation - RUSSIA:

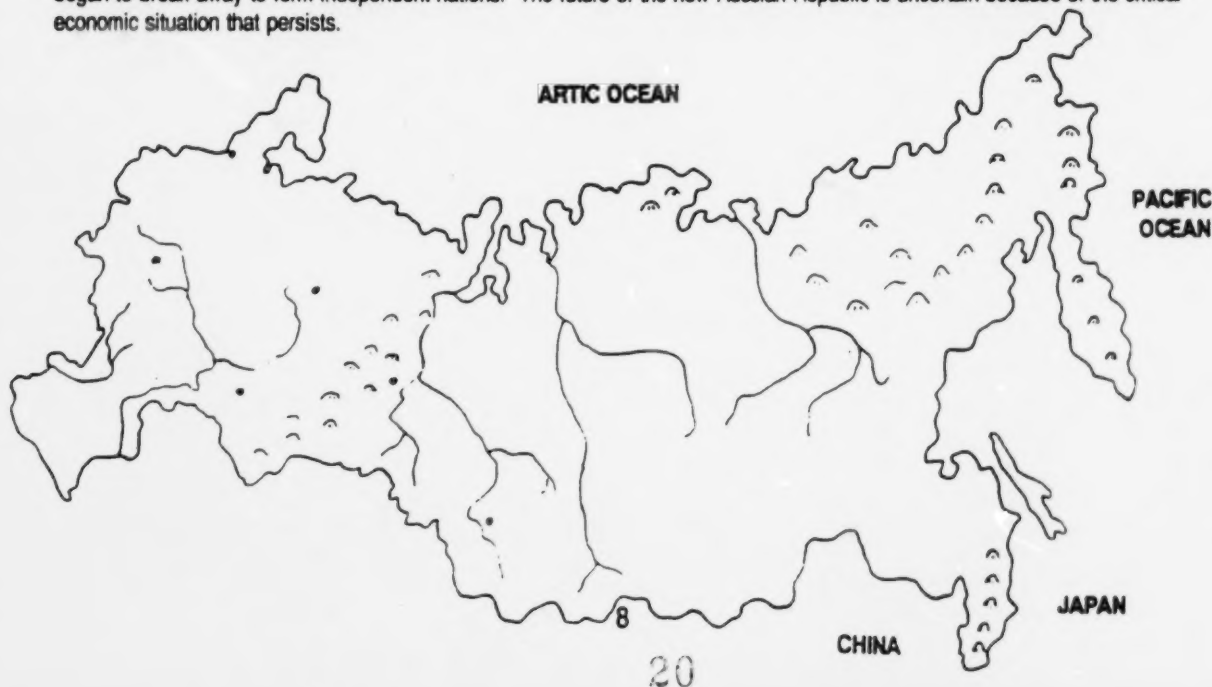
**Geography:** Located on two continents, stretches from eastern Europe across northern Asia to the Pacific Ocean; largest country in the world. **Land area:** Covers one-eighth of the earth's land surface (almost twice the size of Brazil); varies topographically from vast plains to tall mountains (some over 20,000 ft. in elevation) with many rivers, lakes and inland seas. Contains a variety of climates, but much of the territory is cold lying far to the north; 47% of soil contains permafrost.

**Population:** Ethnic groups: Russian 82%, Tatars 4%, Ukrainians 3%, Many others 11%. Life expectancy: 65. Literacy: 99%. **Languages:** Russian (official) and others. **Religion:** Russian Orthodox and Others.

**Economy:** It is moving toward a free market economy and away from having almost all economic enterprises state-owned. It has removed state subsidies for food and housing which has caused a great deal of suffering and dissatisfaction. It will soon withdraw subsidies on energy. Russia has 38% of the proven global reserves of natural gas, the largest in the world, and 13% of the known reserves of coal. Of the world's forests, 25% (temperate forests) lie in Russia.

**Political Data:** Capital is Moscow. Government is in transition. It no longer has a communist government and has moved toward a democratic, parliamentary system under President Boris N. Yeltsin. It now has a multi-party system.

**History:** Slavic tribes began moving into Russia around the 5th century A.D. with the founding of the first Russian state in the 9th century. The Mongols overran the country in the 13th century and were ousted in the 15th century. Ivan the Terrible became the first Tzar in the mid 16th century, and Peter the Great founded the Russian Empire in the 18th. Industrialization brought the Russian Empire into the 20th century, but the political institutions failed to keep pace with the spreading democratic ideas. Tzar Nicholas II, autocratic but weak, took a reluctant Russian people into costly wars against Japan in 1905 and finally Austria-Hungary and Germany in 1914. The 1917 Revolution overthrew the Tzar in favor of provisional democratic governments. They in turn were overthrown in a communist coup with Lenin and the Bolsheviks reorganizing the Russian Empire into the Soviet state. After Lenin's death, a struggle for the leadership ended with Stalin's rise to power. Stalin ruthlessly finished the communization of Russia and concentration of power in himself by either exiling or murdering millions of political opponents. World War II killed over 20,000,000 Soviet people, but they stopped Hitler and the German expansion eastward. After the war tensions between the West and the U.S.S.R. ultimately divided the world into armed camps - NATO members and their allies and the Eastern Bloc within the Warsaw Pact. Though 'hot wars' never broke out between the major powers, the hostilities and tensions were played out in conflicts all over the globe which included Korea, Cuba, Vietnam, the Middle East, Afghanistan, Nicaragua, etc. Mikhail Gorbachev became General Secretary of the Communist Party in March 1985. He not only initiated reforms within the Soviet Union but moved to end tensions with the U.S. These initiatives resulted in treaties reducing nuclear weapons and increasing cultural exchanges. A coup in August 1991 failed to unseat Gorbachev, but it did weaken his control. He ultimately was forced to resign as the former Soviet Union dissolved. A new, democratic Russian Republic under Boris Yeltsin emerged. Other republics within the former U.S.S.R. began to break away to form independent nations. The future of the new Russian Republic is uncertain because of the critical economic situation that persists.



## Getting To Know Your Nation - KINGDOM of SAUDI ARABIA:

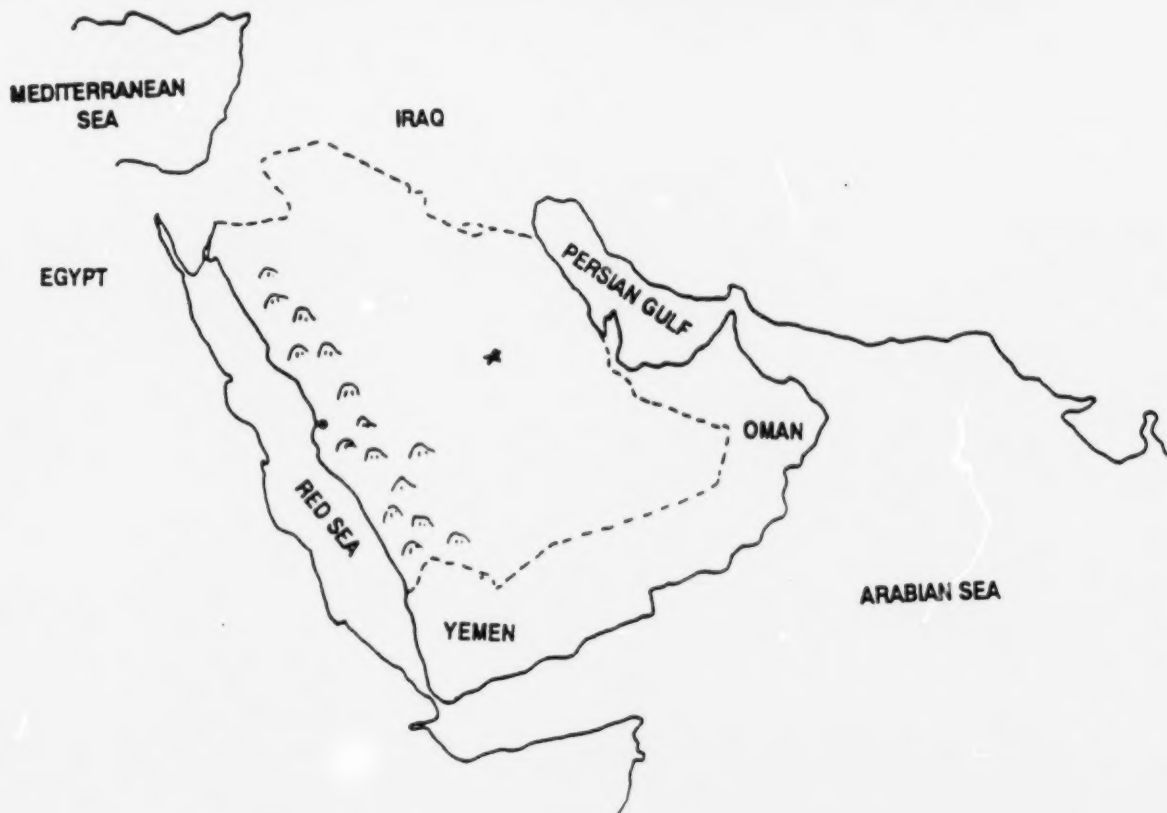
**Geography:** Located on 80% of the Arabian Peninsula in Southwest Asia. Land area: one-third the size of the U.S. The western highlands rise to 9,000 ft., then slope as barren desert to the Persian Gulf to the east. Has two of the world's largest deserts. Much of country is arid desert; some regions are without rain for years.

**Population:** Ethnic groups: Arab tribes; immigrants from other Arab and Muslim countries. Life expectancy: 70. Literacy: 62% (men make up the majority of that number); Language: Arabic. Religion: 100% Muslim.

**Economy:** Developing. Labor Force: about 25% are foreign workers. 14% agriculture (5% arable land); 28% industry and oil; government 34%. Has one-fourth of the world's proven oil reserves and is the world's leading exporter. Estimates of one-fifth of the world's proven natural gas reserves but unexploited.

**Political Data:** Capital is Riyadh. Saudi Arabia is an absolute monarchy with the King as head of state and government. He is advised by the Council of Ministers which he appoints and leads. The country is ruled in accordance with Islamic law. There is no legislature, nor are there political parties.

**History:** Saudi Arabia is the region in which the Islamic religion was born in the 7th century. The city of Mecca is the birthplace of Muhammad, the founder of the religion; he united Arabia in 7th century. His followers conquered much of the Middle East, North Africa and parts of eastern Europe. The region later fell to Turkish rule which lasted until 1913. Oil was discovered in the 1930's and with this the West's intense interest in this region. Since the founding of the State of Israel in 1948, the Saudis have fought with and financed the efforts of other Arab states to oust the Israelis from the region. They joined other Arab nations in condemning the Egyptian peace treaty with Israel in 1979. Even so, the U.S. has pledged the protection of Saudi sovereignty. This led to the U.S. and many other nations becoming involved with the protection of Saudi Arabia after the Iraqi occupation of Kuwait ending in the spring of 1991 with the defeat of Iraq in the Gulf War. Fear of the spreading fundamentalism cause a crack down on dissidents in 1993 and a tightening of the political system. However, since then the country has been divided into 13 regions under governors. Each region is represented in a consultative council; members are appointed by King Faud.



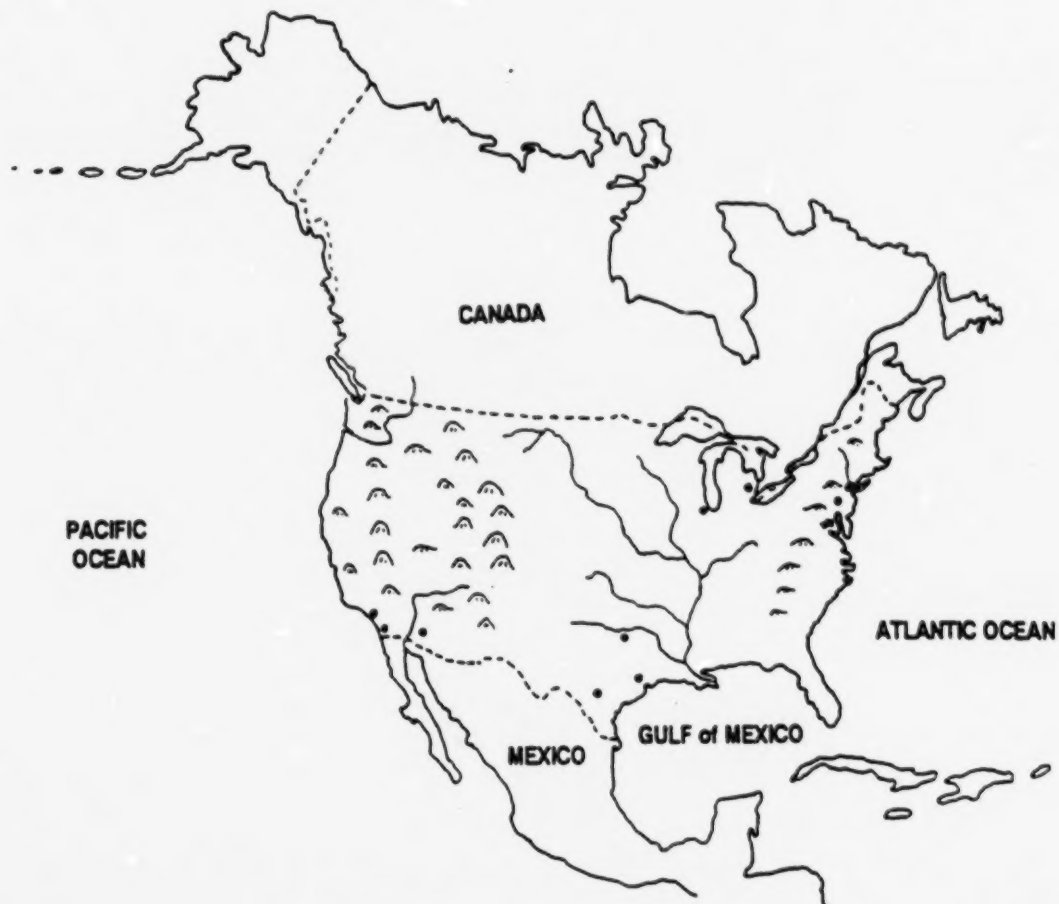
## Getting To Know Your Nation - THE UNITED STATES OF AMERICA:

**Geography:** Located on the North American continent, Canada to the north, Mexico to the south. Land area: third largest country with land area stretching between Atlantic and Pacific Oceans. Varied topography with plains, plateaus, and high mountains. Contains all of world's climates within its boundaries; average annual rainfall varies from 4" in parts of Nevada to 460" in parts of Hawaii, the wettest spot on earth.

**Population:** Majority of population near both seacoasts. Life expectancy: 76. Literacy 97%. Languages: English; Spanish and other languages spoken in various regions. Religions: 58.7% claim a religion - the major religions are 61% Protestant; 25% Roman Catholic; 2% Jewish; and others. The nation has great ethnic diversity resulting from waves of immigration from many areas of the world.

**Economy:** Industrialized. World's largest industrial power. It is also the world's largest debtor nation. Foreign debt is estimated to be \$663,700,000,000. Has a tremendous capacity for research and production. U.S. is the largest consuming nation in the world. It is estimated the U.S. uses some 30% of the world's resources. Other nations compete to sell their products in U.S. economy so U.S. still has great economic clout. U.S. prosperity depends on an active foreign trade. U.S. and Canada jointly have 7% of proven natural gas reserves.

**Political Data:** Capital is Washington, District of Columbia. Constitutional democracy. Three separate branches of government: executive, legislative, and judicial. President is elected for four years. The upper house is the Senate with 100 senators; the lower house is the House of Representatives with 365 members. Further division of power between federal and state governments.



## COMPARATIVE DATA FOR THE NATIONS

| NATIONS      | AREA in sq.mi<br>(1) | POP. '95<br>in MILLIONS<br>(1) | POP.<br>DENS.<br>PER<br>SQ. MI.<br>(1) | % URBAN<br>(1) | '95 POP.<br>DOUBL.<br>TIME (yrs)<br>(1) | '95<br>POP.<br>UNDER<br>AGE 15<br>(1) | PER<br>CAPITA<br>GNP in<br>'93 U.S. \$<br>(1) | ENERGY CONSUMP.<br>(coal equivalent) (2)*** |                              |
|--------------|----------------------|--------------------------------|----------------------------------------|----------------|-----------------------------------------|---------------------------------------|-----------------------------------------------|---------------------------------------------|------------------------------|
|              |                      |                                |                                        |                |                                         |                                       |                                               | Total<br>(millions of<br>metric tons)       | Per Cap.<br>(metric<br>tons) |
| BANGLADESH   | 50,260.              | 119.2                          | 2,371.                                 | 17%            | 29                                      | 42%                                   | \$220                                         | 18.4                                        | .2                           |
| BRAZIL       | 3,265,060.           | 157.8                          | 48.                                    | 77%            | 41                                      | 32%                                   | \$3,020                                       | 190.2                                       | 1.24                         |
| CHINA        | 3,600,930.           | 1,218.8                        | 338.                                   | 28%            | 62                                      | 27%                                   | \$490                                         | 1002.4                                      | .9                           |
| GERMANY      | 134,930.             | 81.7                           | 606.                                   | 85%            | * - growth                              | 16%                                   | \$23,560                                      | 511.2                                       | 6.4                          |
| JAPAN        | 145,370.             | 125.2                          | 861.                                   | 77%            | 277                                     | 16%                                   | \$31,450                                      | 596.9                                       | 4.8                          |
| NETHERLANDS  | 13,100.              | 15.5                           | 1,180.                                 | 89%            | 182                                     | 18%                                   | \$20,710                                      | 109.2                                       | 7.3                          |
| NIGERIA      | 351,650.             | 101.2                          | 288.                                   | 16%            | 22                                      | 45%                                   | \$310                                         | 58.0                                        | .5                           |
| RUSSIA       | 6,592,800.           | 147.5                          | 22.                                    | 73%            | * - growth                              | 22%                                   | \$2,350                                       | **1,895.5                                   | **6.5                        |
| SAUDI ARABIA | 830,000.             | 18.5                           | 22.                                    | 79%            | 22                                      | 43%                                   | \$7,780                                       | 106.6                                       | 6.9                          |
| U.S.A.       | 3,539,230.           | 263.2                          | 74.                                    | 75%            | 105                                     | 22%                                   | \$24,750                                      | 2,791.1                                     | 11.0                         |

\*Negative Growth - declining population.

\*\*Numbers are for the former U.S.S.R. since numbers for the Russian Federation were unavailable in 1994.

\*\*\*Statistics include energy from solid fuels (*bituminous coal, lignite, peat, and oil shale burned directly*), liquid fuels (*crude petroleum and liquid natural gas*), gaseous fuels, and primary electricity production (*wind, tide, wave, solar and hydroelectric*). Traditional fuels (*such as firewood, animal and vegetal waste*) as well as bagasse (*an energy source derivative from sugar cane production*) were included since they continue to be significant sources in developing countries.

### SOURCES:

- (1) THE 1995 WORLD POPULATION DATA SHEET, Population Reference Bureau, Inc., 1875 Connecticut Avenue, NW, Suite 520, Washington, D.C. 20009 (202) 483-1100
- (2) THE WORLD RESOURCES 1994-95 A Guide to the Global Environment, A Report by the World Resources Institute in collaboration with The United Nations Environment Programme and the UN Development Programme, Oxford University Press, New York 1994, pp. 334-335, 342-343.

## BACKGROUND INFORMATION - GLOBAL CLIMATE CHANGE

The decade of the 1980's was the warmest since meteorologists (*scientists who study weather patterns*) began keeping records more than a century ago. Six of the warmest years on record were in the 1980's. However, 1990 topped the record of the past 140 years, with 1991 as the second warmest. After 1991, average global temperatures began to cool, then rise again in 1994, returning to the warmth of the 1980s. Was this a normal fluctuation of nature, or was this evidence of the beginning of global climate change caused by the much publicized 'greenhouse effect'?

Scientists and government representatives from around the world have been studying the scientific basis for climate change. Although scientists differ in their predictions of future climate change, they agree that the composition (*make-up*) of the atmosphere is being transformed because of the activities of human beings. This change has the potential for dramatically altering the climate of the planet on which we all live. They are trying to agree on a course of action to lessen the potential for unknown global consequences.

All nations of the Earth hold certain things in common which are owned by none but shared by all. We breathe the same air, share the same oceans, over time use the same land, and experience the forces of the Earth's climate. These things are sometimes referred to as **the Commons**. If we continue to alter these **Commons**, we could see a change in the quality of our lives or those of future generations.

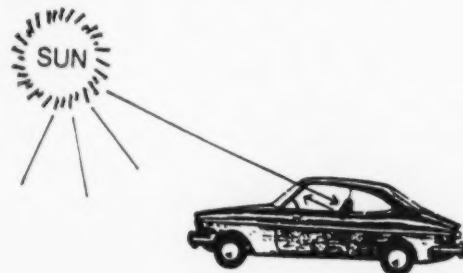
Scientists and statesmen from all over the world are beginning to agree on a new way of thinking about economic and industrial development. It is called **sustainability** or **sustainable development**. According to this concept, the world's populations must find better ways to achieve prosperity and well-being that lessen the threat to **the Commons**. This means finding new paths for economic and social progress that 'meet the needs of the present without compromising the ability of future generations to meet their own needs.' Nations have begun negotiating treaties that would limit the destruction of the Earth's intricate ecosystems to maintain an environment in which our children and grandchildren can enjoy the same quality of life as we do.

We are entering a time of unknown consequences of our actions. If we come to understand how our actions and natural forces interact, we will be able to make intelligent choices for the future while choices still exist.

### WHAT IS THE 'GREENHOUSE EFFECT'?

We know from studying the climate of past geologic ages that the temperature of the Earth's atmosphere has fluctuated up and down. We have had 'ice ages' and warmer periods. Usually, the temperature changes occurred slowly over hundreds or thousands of years. Plant and animal species have either adapted to these changes or, at times, become extinct because of the fluctuations in temperatures.

There are certain gases in the Earth's atmosphere that tend to trap in the sun's heat. These gases have been named 'greenhouse' gases. This is similar to leaving your car in the sun and returning to find a much warmer inside temperature. The car's glass area has allowed the sun's radiation to enter. The seats, dashboard, etc. have absorbed the radiation, and the glass has trapped the heat inside. The warmer periods of the Earth's history have had greater concentrations of these 'greenhouse' gases that trap in the sun's heat.

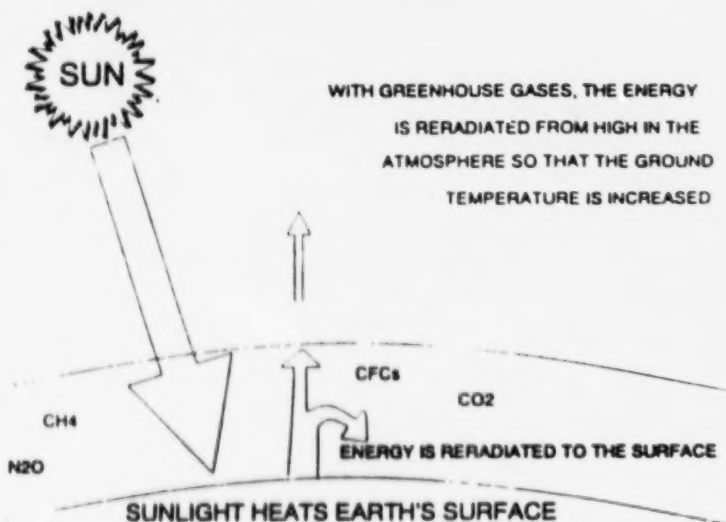


More than 99% of the Earth's atmosphere is made up of oxygen and nitrogen, gases which don't trap radiant heat from the sun. However, the other 1% include the 'greenhouse' gases. These greenhouse gases trap in the sun's radiant heat and are responsible for the life-sustaining temperatures of the atmosphere. Without the 'greenhouse effect,' our planet's atmosphere would be much colder. Life as we know it would not exist.

The atmosphere of Mars, our neighboring planet, has too little greenhouse effect. It appears to be cold and lifeless. On the other hand, Venus has large quantities of greenhouse gases and is thought to be 400-500° C (centigrade) warmer because of this. The Earth seems to be unique in our Solar System in having the right temperatures and mixture of gases to support higher forms of life.

As a result of the burning of fossil fuels as well as our processes in agricultural and manufacturing, vast quantities of these greenhouse gases are being released into the atmosphere. Concentrations of these gases are increasing.

## GREENHOUSE EFFECT

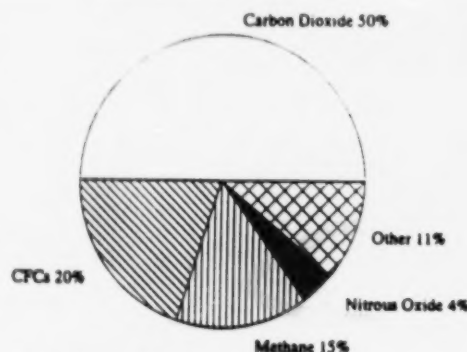


## WHAT ARE THE GREENHOUSE GASES?

There are several gases that are responsible for the greenhouse effect. In addition to naturally occurring water vapor, human activities are dramatically increasing the levels of carbon dioxide (CO<sub>2</sub>), chlorofluorocarbons (CFC's), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O).

The concerns of the scientists are twofold. First, the tangible or concrete effects of the increased concentrations of greenhouse gases will not become evident until the next century. Second, the longer we wait to have solid evidence before taking corrective actions, the more difficult it will be to slow climate change.

### GREENHOUSE GASES FROM HUMAN ACTIVITIES

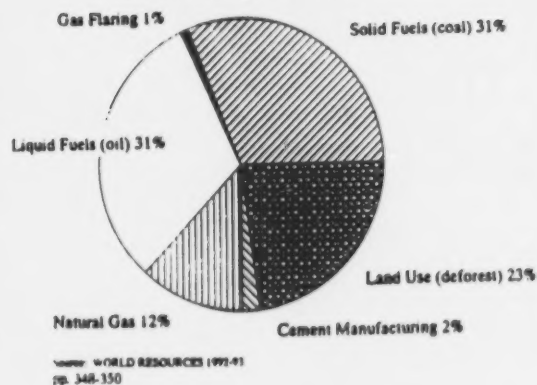


Source: Journal of Air Waste Manage. Assoc., Vol. 40, March 1990, p. 292

**Carbon dioxide (CO<sub>2</sub>)** will be responsible for about half of the man-made additions to the greenhouse effect, it is estimated. Since the beginning of the Industrial Revolution, some 150 years ago, the amount of CO<sub>2</sub> in the atmosphere has doubled. The rate of increase is still rising today. The main sources of the increase in CO<sub>2</sub> are from the burning of fossil fuels (*coal, oil, and natural gas*) in power plants, factories, homes, and automobiles; the cutting and burning of the Earth's forests; and the manufacture of cement.

As they are burned, fossil fuels release carbon dioxide into the atmosphere. These fuels release varying quantities of this gas. Coal is highest in the release of  $\text{CO}_2$ . Petroleum is the next highest. *(In burning a gallon of gasoline, an automobile will emit twenty pounds of carbon dioxide into the atmosphere.)* The cleanest burning fossil fuel is natural gas; it releases the least amount of  $\text{CO}_2$  per thermal unit. The ratio of carbon content in these fossil fuels is 1:0.8:0.6 - coal, petroleum, natural gas. Trees act as a storehouse of carbon. As trees grow, they 'breathe' in  $\text{CO}_2$ . When they are burned, they release this carbon in the form of  $\text{CO}_2$ . Therefore, as forests are cleared, the net amount of  $\text{CO}_2$  in the atmosphere increases.

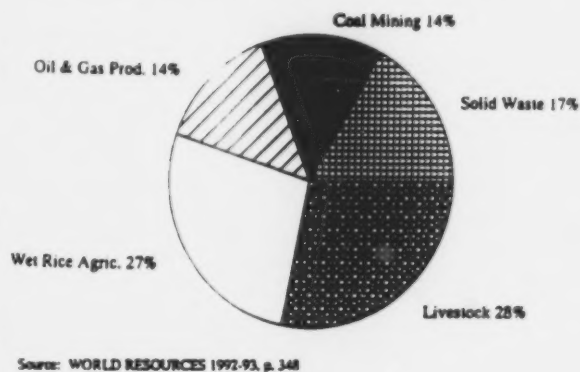
SOURCES OF CARBON DIOXIDE FROM HUMAN ACTIVITIES



**Methane ( $\text{CH}_4$ )** from natural and man-made sources is increasing in the atmosphere at the rate of about 1% a year. Natural sources account for 40% of the new methane. The remainder comes from human activities such as rice cultivation, cattle production *(each cow produces approximately 14 cubic feet of methane daily as a by-product of digestion)*, waste disposal *(landfills)*, and the production and transportation of fossil fuel products.

Methane  $\text{CH}_4$  has a greater heat-trapping quality than  $\text{CO}_2$ . One molecule of methane will trap about 20-30 times more heat than a molecule of  $\text{CO}_2$ . Therefore, a smaller quantity of this gas will cause more heating of the atmosphere. Methane accounts for about 15% of the man-made share of the increase in the greenhouse effect. *(World Resources 1990-91, p.24.)*

SOURCES OF METHANE FROM HUMAN ACTIVITIES



**Chlorofluorocarbons (CFCs)** account for 20% of the man-made share of the increase in the greenhouse effect. Used since the 1930's, these gases have provided a cheap source of coolants in refrigeration and air-conditioning. They are also used in the manufacture of some foams, in industrial products such as computer chips, as solvents for cleaning circuit-board equipment (the electronics industry has been estimated to use 20% of all CFCs), and as propellants in some aerosol sprays.

CFCs can remain in the atmosphere for up to 400 years and are up to 20,000-30,000 times more effective than  $\text{CO}_2$  in trapping heat. Once thought to be completely harmless gases, CFCs have been found to cause destruction of ozone in the upper reaches of the atmosphere. The ozone layer protects lifeforms from harmful ultra-violet radiation from the sun. The use of CFCs has already been restricted by international treaty because of their damage to the ozone layer. Because there is no readily available, harmless substitutes, some nations have been hesitant to sign the treaty out of concern that their economic development will be slowed. CFCs are still widely being used.

**Nitrous oxide ( $\text{N}_2\text{O}$ )** sources are at present poorly understood. It is known that one source of release into the atmosphere is through fertilized soils. Nitrous oxides are two hundred times as heat absorbent as  $\text{CO}_2$  adding about 6% to the man-made emissions of greenhouse gases.

## WHAT ABOUT THE CRITICS?

Scientists now agree that greenhouse gases in the atmosphere are increasing, and that these increases have the potential to change the Earth's climate. The disagreements have been over how the Earth's climate will respond and whether or not human activity has contributed to it. Some point out that there have always been temperature fluctuations - ice ages, global warming, then cooling and so on. Some believe that warmer temperatures could possibly produce more cloud cover, thereby slowing the rising atmospheric temperatures. Others maintain that the earth is actually cooling. Some arguments have been based on a drop in the average global temperatures in 1991-1994. However, temperatures have now returned to the highs of the 1980s. *(The eruption of Mount Pinatubo in the Philippines in June 1991 threw so much debris into the atmosphere, the sun's radiance was temporarily blocked. The debris has now fallen back to earth.)*

Arguments against global climate change and the role of human activity have become less credible as more data becomes available. In December 1995, the United Nations Intergovernmental Panel on Climate Change issued a statement reporting that "the increase in the average global temperatures over the last century of 0.3°-0.6° C is unlikely to be entirely due to natural causes." Instead, the climate records show patterns that identify human activities as important contributors to the warming. It is now understood that the earth could be experiencing even more pronounced effects from the greenhouse gases were it not for **aerosols**.

**Aerosols** are small solid particles or droplets that result from the burning of fossil fuels or the smelting of ores. Fossil fuels - coal and oil, and wood *(to a lesser degree)* - contain sulfur. When burned, fossil fuels release sulfur dioxide (SO<sub>2</sub>) into the atmosphere. There, a complicated chemical reaction changes them into aerosols. Too small to fall very rapidly, the aerosols hang around in the atmosphere and do mischief. One of the chief 'aerosol mischief makers' is sulfuric acid. *(Sulfuric acid causes acid rainfall that is creating serious problems in some of the world's forests and water systems.)* Aerosols scatter some of the sunlight in the regions where they have been released into the atmosphere. By causing less sunlight to reach the earth in that region, they lessen the effect experienced there of the greenhouse gases. Nevertheless, warming is taking place. Regions with less aerosol concentrations are experiencing the warming.

Scientists use computers to model how the atmosphere behaves with greenhouse gases. Theoretically, they have known that aerosols should be cooling the Earth's surface and could actually be masking or slowing down the effects of an increase in the greenhouse gases in the atmosphere. But, they haven't been able to pin down the evidence of aerosol cooling. Then, in 1995, researchers from several parts of the world confirmed the data. "The evidence is pretty substantial that we are seeing the aerosol effect," says climate modeler Jeffrey Kiehl of the National Center for Atmospheric Research. *(Kerr, SCIENCE, 12 May 1995, p. 802)* Through global scientific research, the effects of human activities on global climate is increasingly understood.

## WHAT EFFECTS MIGHT RESULT FROM AN INCREASE IN GREENHOUSE GASES?

Through the use of computer models, scientists are attempting to predict what the effects might be of a major increase in greenhouse gases. Possible changes and consequences include the following:

- I. Most scientists and computer models predict a warming of 1°-3.5° by the year 2100. *(Kerr, SCIENCE, 3 November 1995, p. 731)*. This would eventually cause a rise in the level of the oceans. Estimates are for a rise of over one to three feet by the year 2100. *(Titus, p. 135)* As the atmosphere warms so will the temperature of the oceans. Since warmer water expands in volume, the level of the oceans will rise. This would cause flooding in low-lying areas, destruction of food-rich wetland ecosystems, and salt contamination of river deltas and underground water supplies near the oceans.

2. Weather patterns would change as the temperature of the atmosphere and the oceans increases. This could cause disruptions in agricultural patterns and affect the health and comfort of much of the population of the Earth. The middle and higher latitudes (locations such as the United States, Canada, and Europe) would see the most change.
3. Tropical storms (hurricanes, typhoons, etc.) and periods of drought could become more severe and frequent causing widespread damages and loss of agricultural output.
4. As weather patterns change, we could possibly witness the alteration of entire ecosystems. Plant and animal species that could not adapt to a rapidly changing environment would become extinct.

### WHAT IS BEING DONE?

Scientists are trying to better understand the complexities while governments are debating what steps their nations can take. Political decisions of nations are based on the level of risk and their economic realities.

Since a reduction in the use of CFCs has been negotiated in other treaties and little is known about the sources of  $N_2O$ , the focus of climate change conferences is on levels of carbon dioxide and methane. Some scientists believe that a reduction by 10% in methane emissions could stabilize the harmful effects of the gas in the atmosphere. With better technology and an investment of money, this 10% reduction would not be difficult. If the methane in coal mines was captured and used instead of vented into the air, and if natural gas pipelines around the world were improved to lessen leakage, we would see such a reduction.

Carbon dioxide reduction is a more difficult problem since much of our modern life depends on economic activity that produces  $CO_2$ . Nations and the scientific communities are spending large sums of money and time in searching for alternatives to fossil fuels. These efforts, it is believed, will end in success sometime during the next century. In the meantime, solutions to the problem of excess fossil fuel consumption are centered on conservation, greater fuel efficiency and the use of the cleaner burning fuels. Some nations, especially the European Community, are setting their own limits on  $CO_2$  emissions without waiting for an international treaty.

Proposals have been made to use 'carbon taxes' to reduce the amount of  $CO_2$  in the atmosphere. Fuels with the highest concentrations of carbon content per unit of energy would be taxed the most so that they will cost the most. Some nations are using the carbon ratio in coal, oil, natural gas - 1: 0.8: 0.6 - as a basis for the tax. Money collected from the carbon tax will be used to lower other taxes and to encourage investment in more efficient technology, thus further reducing the  $CO_2$ . Industries and other consumers will have an incentive to change to cleaner burning fuels such as natural gas and alternative energy sources such as solar and wind power. Some nations are turning to nuclear power for electrical generation because it does not contribute to greenhouse gas concentrations. But nuclear energy has other problems.

Other areas that need to be addressed are: deforestation as a major source of  $CO_2$ ; population growth as a spur to increased use of resources, thus more greenhouse gases; and the issue of debts of nations as a cause for resource depletion. Some nations find that the only way to repay their debts or simply the interest on the debt is to cut down their forests to expand agriculture and timber exports.

As science helps us to understand climate change, it is now up to the political will of the people to make sustainable decisions.

## SOURCES of GREENHOUSE GASES from HUMAN ACTIVITY

| GREENHOUSE GASES                                             | GAS                                                                       | SOURCES/CAUSES              | BLDSH  | BRAZIL    | CHINA     | GRMNY*  | JAPAN     | NTHLND  | NIGERIA | RUSS***   | SAUDI AR | USA       |
|--------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------|--------|-----------|-----------|---------|-----------|---------|---------|-----------|----------|-----------|
|                                                              | THOUSANDS of METRIC TONS (one metric ton = 2,204 lbs. or 1,000 kilograms) |                             |        |           |           |         |           |         |         |           |          |           |
|                                                              | CO <sub>2</sub><br><br>C D<br>A I<br>R B<br>O X<br>O I<br>N D<br>E        | CEMENT MANUFACTURING        | 187    | 12,458    | 103,068   | 13,201  | 40,506    | 1,762   | 1,744   | 69,752    | 4,749    | 34,892    |
|                                                              |                                                                           | BURNING SOLIDS (coal,wood)  | 480    | 39,124    | 1,964,032 | 283,623 | 303,995   | 31,228  | 264     | 1,328,885 | 0        | 1,826,149 |
|                                                              |                                                                           | BURNING LIQUIDS (petroleum) | 6,031  | 146,816   | 292,699   | 247,478 | 603,157   | 27,667  | 32,826  | 1,237,842 | 110,261  | 2,075,685 |
|                                                              |                                                                           | BURNING NATURAL GAS         | 7,416  | 6,533     | 28,817    | 96,568  | 92,816    | 64,105  | 8,295   | 1,129,996 | 51,270   | 924,735   |
|                                                              |                                                                           | GAS FLARING (production)    | 0      | 2,023     | 0         | 531     | 81        | 227     | 36,131  | 37,530    | 7,497    | 7,548     |
|                                                              |                                                                           | LAND USE CHANGE (deforest.) | 8,700  | 950,000   | NA*       | NA*     | NA*       | NA*     | 270,000 | NA*       | NA*      | 22,000    |
|                                                              | CO <sub>2</sub> TOTAL EMISSIONS - 1989                                    |                             | 22,814 | 1,158,957 | 2,388,613 | 641,398 | 1,040,554 | 124,990 | 349,283 | 3,804,001 | 173,776  | 4,891,005 |
|                                                              | CH <sub>4</sub><br><br>M E<br>T H<br>A N<br>E                             | SOLID WASTE                 | 250    | 340       | 2,600     | 1,500   | 2,400     | 290     | 240     | 4,600     | 29       | 17,000    |
| COAL MINING                                                  |                                                                           | NA*                         | 4      | 13,000    | NA*       | 150     | NA*       | NA*     | 7,600   | NA*       | 8,100    |           |
| OIL & GAS PRODUCTION<br>(includes nat. gas pipeline leakage) |                                                                           | 60                          | 200    | 230       | 196       | 37      | 630       | 2,700   | 13,000  | 960       | 5,200    |           |
| WET RICE AGRICULTURE                                         |                                                                           | 5,100                       | 430    | 19,000    | NA*       | 1,400   | NA*       | 140     | 370     | NA*       | 740      |           |
| LIVESTOCK                                                    |                                                                           | 970                         | 7,700  | 5,300     | 1,250     | 280     | 260       | 630     | 7,900   | 90        | 6,000    |           |
| CH <sub>4</sub> TOTAL EMISSIONS - 1989                       |                                                                           | 6,900                       | 8,800  | 40,000    | 3,680     | 4,100   | 1,200     | 3,700   | 34,000  | 1,100     | 37,000   |           |
| CFC's TOTAL EMISSIONS - 1989                                 |                                                                           | NA*                         | 6      | 12        | 34        | 95      | 6         | 0       | 67      | 3         | 130      |           |
| GREENHOUSE INDEX RANK -1989                                  |                                                                           |                             |        |           |           |         |           |         |         |           |          |           |
| % TOTAL NET EMISSIONS of GREENHOUSE GASES - 1989             |                                                                           |                             |        |           |           |         |           |         |         |           |          |           |

\*Information Not Available \*\*Data combines numbers from the former East and West Germany

\*\*\*Numbers are from the former U.S.S.R.; they are not available from the Russian Republic alone.

SOURCE: WORLD RESOURCES 1992-93, pp. 348-350.

**GLOBAL CLIMATE CHANGE AND ACCOUNTABILITY - BANGLADESH**  
**YOUR NATION and ATMOSPHERIC CONCENTRATIONS of GREENHOUSE GASES:**

You are concerned about global climate change and possible global warming because you are experiencing devastating floods. Historically, you have had major floods about once every 50 years. In the 1970s and 80s, however, the average has been a flood every 4 years or less. (Refer to "Getting to Know Your Nation.") This partly has to do with the Himalayan watershed north of you which has become deforested. The mangrove forests which break the impact of waves along the coastal regions have been destroyed making coastal populations vulnerable to storms and rising sea levels.

**Carbon Dioxide CO<sub>2</sub>** Ninety percent of your rural household energy comes from biomass often called traditional fuels [gathered fuelwood, dung (*animal excreta*), charcoal and crop residue]. This use of traditional fuels does not cause a net increase of CO<sub>2</sub> in the atmosphere. Therefore, the emissions from the burning of traditional fuels are not included in the numbers on the Source Table, p. 17. But deforestation does cause a net increase and remains an important source. Between 1970-85 your demand for these traditional fuels increased by 30 to 40%. This means on-going pressure on any forested area for fuelwood.

In regard to fossil fuels you are producing some oil from the Bay of Bengal. You have coal in your northern districts; however, removal is difficult since the coal is located at a depth of more than 3,000 ft. When your coal can be more easily extracted and your oil production increased, you could become a great emitter of CO<sub>2</sub> emissions. You have some natural gas; at the rate of your present use, it is considered sufficient for 200 years. You are producing enough to export. With better technology you could possibly produce more. In 1989 you had only 39,000 passenger and 51,000 commercial motor vehicles in use.

**Methane CH<sub>4</sub>** You now grow 5% of the world's rice which is the main staple of your diet, and 23 million cattle (1989). Population growth is a major concern. Look at your population's doubling time and per capita GNP on the Comparative Data Chart.

**Chlorofluorocarbons CFCs:** Since CFCs are used in high tech industry, refrigeration, and air-conditioning, you have not been the cause of the problem.

**Accountability:** You are ranked as No. 40 in the greenhouse index rank according to the IPCC. It is estimated that you contribute 0.4% of the total net emissions of greenhouse gases. (WORLD RESOURCES 1992-93, p. 208)

## GLOBAL CLIMATE CHANGE AND ACCOUNTABILITY - BRAZIL YOUR NATION and ATMOSPHERIC CONCENTRATIONS of GREENHOUSE GASES:

Brazil is the fifth most populated country in the world and has the world's largest remaining tropical forests. It is a critical source of global biological diversity (*thousands of species of plants and animals*). Your economic growth caused the destruction of more than 95% of the Atlantic coastal rain forest along with the coniferous forests of southern Brazil. Still, nearly 90% of the forest of the Amazon is relatively untouched.

**Carbon Dioxide CO<sub>2</sub>:** Deforestation or land-use change contributes 23% of the global CO<sub>2</sub> from human activity. Brazil is responsible for 15% of global emissions of CO<sub>2</sub> from deforestation and is the largest single nation-source. (*WORLD RESOURCES 1992-93, p. 345.*) Your nation's role in the destruction of the tropical rainforest began through land reform programs as incentives to landless peasants. At that time 2% of the landowners controlled 60% of the arable or productive land. Through incentives and subsidies (*supplemental aid*) there was settlement and commercial ventures into the interior of the Amazon Basin. Between 1966-83 wealthy investors along with small farmers cut down and burned the forests so they could use the land for agriculture and cattle production. (*It has been estimated that 77,000 square miles of rainforest were burned in 1987 alone, an average of 5,000 fires burning on any given day.*)

But in 1988 there was a change of policy. Government subsidies were discontinued. In May 1991 the government proposed a pilot program protecting tropical forests for national parks and forests for biodiversity and carbon 'sinks'. Rubber tappers are now demonstrating alternative forms of 'development.' The state-owned forests are managed by the local communities as 'extractive reserves' for uses such as rubber tapping and gathering of Brazil nuts. Since 1987 fourteen extractive reserves covering over 7.4 million acres have been officially recognized. Eventually they hope to manage some 247,000,000 acres, approximately one quarter of the Amazon Basin. (*STATE OF THE WORLD 1992, p. 21*) You are hosting the U.N. world environmental conference in June, 1992. The hope has been to sign a global climate treaty at that time.

Short of fossil fuels, you grow crops for synthetic fuels to power your automobiles. Brazil decided to substitute pure ethanol and gasohol (*mixtures of ethanol and gasoline*) because of high priced petroleum imports. These imports had helped to drive up your foreign indebtedness. In 1988 you had 14 million passenger and 1.6 million commercial vehicles in use. At the height of the program 90% of new cars sold in Brazil were powered by ethanol. (*In 1989, over 8.4 million gallons of gasoline were saved per day in approximately 5 million Brazilian automobiles by burning ethanol.*) (*Reddy and Goldenberg, p. 115.*) Use of these synthetic fuels do not cause a net increase of CO<sub>2</sub>, and they significantly improve air quality. The alcohol industry also created 700,000 jobs. Brazil established an entire fuel cycle -from source (sugarcane) to end-use (alcohol-fueled automobiles). They even burn the residue (left after crushing the sugar to drain the juice) to make steam to generate electricity.

But production had to be cut in recent years. When oil prices fell in the 1980s, the synthetic fuel industries couldn't compete with lower priced imported petroleum. Synthetic fuels had to be subsidized. Economic problems (caused by debt burden and servicing), forced the cost of ethanol to go down even further. Finally, with improved productivity of sugarcane agriculture and ethanol production, ethanol costs really have fallen. Brazilian ethanol distilleries have become the best in the world and now compete strongly in the world market.

**Methane CH<sub>4</sub>:** You grow 2% of the world's rice. You raised 136 million cattle in 1989.

**Chlorofluorocarbons CFCs:** You are a developing nation using CFCs in your high tech industries and for refrigeration and air-conditioning.

**Accountability Ranking:** You are ranked No. 6 in greenhouse index rank. It is estimated that you contribute 3.9% of the total net emissions of greenhouse gases. (*WR 1992-93, p. 208*) These numbers reflect a decrease in your deforestation and burning. In 1987 deforestation was 10.5% of total net emissions.

## **GLOBAL CLIMATE CHANGE AND ACCOUNTABILITY - CHINA**

### **YOUR NATION and ATMOSPHERIC CONCENTRATIONS of GREENHOUSE GASES:**

With over one-fifth of the world's population you have taken drastic measures to cut back on population growth. You are succeeding. You average 2.3 children per family; but this number still means growth. Your population is demanding a better standard of living. Therefore, the government has to take major steps in satisfying this demand. One means is by providing more consumer products such as refrigerators. Refrigeration enables families to buy and prepare food several days in advance, thus, giving more time to other areas of the economy.

**Carbon Dioxide CO<sub>2</sub>:** You have 50% of the world's coal deposits and are the largest producer. Coal provides 73% of the energy you need for your economy. Your coal and oil-burning industries are inefficient and have no pollution controls. And of all the coal used in China, one quarter is burned for the heating of residences. Again, this use adds to air pollution. Your per capita energy consumption is small compared to that of developed nations (Refer to the Comparative Data Table). However, because of the size of your population and your reliance on coal, you contribute substantially to CO<sub>2</sub> greenhouse gas concentrations. And, you are planning to double your coal consumption by the year 2000! You could well become the largest nation-source of CO<sub>2</sub> emissions; at present, you are the fourth largest. (*WORLD RESOURCES 1992-93, p. 349*)

In 1988 you had 1.3 million passenger and 3.1 million commercial vehicles in use. You have some oil and gas reserves (1% of world's proven reserves) making it possible to be self-sufficient at present level of use.

In the spring of 1992 your congress voted to build a multi-billion dollar hydro-dam across the Yangtze River. It will be the biggest dam in the world generating much of the electricity needed in central China. However, it remains controversial; it will displace an estimated one million people. (*National Public Radio, "All Things Considered", April 3, 1992*).

**Methane CH<sub>4</sub>:** Of the global total of 270 million metric tons of CH<sub>4</sub>, China is the largest emitter - 40 million metric tons. But you are also the world's largest user of methane gas which means you burn it for energy. 26% of the global total emissions of CH<sub>4</sub> from wet rice agriculture and 33% of the global total from coal production comes from you. (*WORLD RESOURCES 1992-93, p. 345*)

You have become mostly self-sufficient in food production. You raise 35% of the world's annual rice crop, and in 1989 you raised 77 million cattle.

**Chlorofluorocarbons CFCs:** Your government has set a goal of all families owning refrigerators. This could increase energy consumption as well as the use of more CFCs without better technology. Your scientists and engineers are, however, well on the path to developing a substitute.

**Accountability:** You are ranked as No. 3 in the **greenhouse index rank** according to the IPCC. It is estimated that you contribute 9.1% of the total global emissions of greenhouse gases. (*WORLD RESOURCES 1992-93, p. 208*).

## GLOBAL CLIMATE CHANGE AND ACCOUNTABILITY - GERMANY

### YOUR NATION and ATMOSPHERIC CONCENTRATIONS of GREENHOUSE GASES:

You have just reunited as one German nation which has meant rebuilding the infra-structure of the former East Germany. It is giving you opportunities to look to new sources of energy for answers. Now, the reunited Germany is taking a leadership role in both the European Community (EC, the 12 full members of the Common Market) and the global community in environmental commitments. Even so, it is important to note that you industrialized nations have only one quarter of the world's population, yet you consume about 80 percent of the world's goods. (*MacNeill, Scientific American, p. 156.*) Knowing this you are committed to sustainable development, development that does not further deplete resources from future generations.

**Carbon Dioxide CO<sub>2</sub>:** You had 28.8 million passenger and 1.3 commercial motor vehicles in use in 1988. Your price of gasoline or 'petro' is over \$4 per gallon. It is heavily taxed to finance clean-ups and the rebuilding of East Germany. These taxes also finance investments in energy efficiency and renewable sources of energy. These taxes also reflect the real cost of bringing that gasoline from the drill head to the pump - environmental degradation, carbon emissions, etc. have gone into the price. Your automobile fleet is very efficient, getting over 26 mpg (US) on the average. This is compared with the least efficient of the industrialized nations, the United States, averaging 21 mpg (US). It has been shown that higher priced fuels go hand in hand with efficiency. (*WORLD RESOURCES 1992-93, p. 21*) You are also moving rapidly to develop electric vehicles. BMW, for instance, introduced a new four-passenger electric car in an auto show in 1991 with a range of 250 kilometers.

Along with the rest of the European Community you support cutting taxes by 90% on biofuels. They had been taxed at the same rate as fossil fuels. You are trying to encourage the commercial production and use of methanol, ethanol, and other plant-derived petroleum substitutes. In addition to decreasing CO<sub>2</sub> emissions from transportation, it is creating new opportunities for farmers. These fuels would decrease an estimated 25% of the total CO<sub>2</sub> emissions from the European Community (EC). (*GLOB. ENVIRON. CHANGE REPORT, February 29, 1992, p. 5*). Also over 15% of all passenger travel is by mass transit (*Bleviss and Walzer, p. 108*).

You are committed to finding alternative sources of energy. Researchers are looking into hydrogen as a fuel for the future. You have organized a joint industry-government program with a sizeable budget for research. BMW and Mercedes-Benz have built prototype or model hydrogen-powered cars. (*STATE OF THE WORLD, p. 45*) You are also looking at hydrogen for use as an aviation fuel and as a means of efficient production of electricity. Wind power is beginning to be used in northern Germany.

Germany, along with other members of the European Community, are committed to using natural gas in new power plants. Somewhere between 50-60% of all new power plants being built by members of the European Community are fueled with natural gas. This is a commitment to buy natural gas from Russia which means building 'state of the art' pipelines. And, to help stabilize CO<sub>2</sub> emissions from deforestation, Germany has officially stopped using tropical timber which helps decrease demand for this forest product.

**Methane CH<sub>4</sub>:** Your number of cattle in 1987 was 14.8 million. You are not a major grower of rice.

**Chlorofluorocarbons CFCs:** Germany along with Netherlands has led the way in calling for early European Community phaseout of CFCs. This proposal calls for CFCs to be reduced by 85% from the 1986 levels by the end of 1993.

**Accountability:** You are ranked No. 7 in the greenhouse index rank. It is estimated by the IPCC that you contribute 3.4% of the total global emissions of greenhouse gases. (*WORLD RESOURCES 1992-93, p. 208.*)

## GLOBAL CLIMATE CHANGE AND ACCOUNTABILITY - JAPAN

### YOUR NATION and ATMOSPHERIC CONCENTRATIONS of GREENHOUSE GASES:

You have a high standard of living but few natural resources. You have to rely on the rest of the world for what you need for your industries and personal consumption. It is important to note that you industrialized nations have only one quarter of the world's population, yet you consume about 80 percent of the world's goods. (MacNeill, *Scientific American*, p. 156.)

**Carbon Dioxide CO<sub>2</sub>:** Since you have few natural resources, reliable energy sources have been a major concern. Oil imports have had to come from foreign sources with fluctuating prices. It has caused you to look to self-sufficiency. You have become the most energy-efficient industrial economy. Your energy consumption per unit of economic output (called energy intensity) is one half of that of the U.S. and is also lower than that of Western Europe and developing countries. Even with a high level of energy efficiency Japan is the world's third largest source of CO<sub>2</sub> emissions. These emissions average 8.4 metric tons per person per year as compared with 19.68 in the U.S. and 8.43 in The Netherlands. (1989 figures).

You are moving toward reliance on nuclear power for the generation of electricity. Over forty new nuclear power plants have been planned. For historical reasons your citizens are not comfortable with that. Several small nuclear accidents have raised many questions about this as a major source of electrical generation. Alternative sources such as photovoltaic cells have received attention as a means of producing electricity. Japan took over the leadership in solar research from the United States during the 1980s. Japan imports more than half of all imports of broad-leaved logs and one fourth of roundwood and coal. You import 40% of your wood products from tropical nations. (Miller, p. 26.) You are logging in Malaysia, Indonesia and other southeastern tropical forests. Much of these large quantities of imported woods are used for plywood and cardboard packaging for exports. The plywood is used two or three times as forms for concrete in building, and then the wood is discarded. Indirectly, you are causing deforestation because of your large demand.

In 1989 you had 30.7 million passenger and 21.4 million commercial motor vehicles in use. Yet in 1990, 47% of all passenger travel was by mass transit. (Bleviss and Walzer, p. 108) You have considered the use of biomass fuels. But you are limited by the amount of land needed to grow the crops from which they are produced. You have been moving rapidly to develop electric vehicles. Eight Japanese companies have developed intensive electric vehicle programs and have exhibited models or prototypes. (WORLD RESOURCES, 1992-93, p. 150.)

**Methane CH<sub>4</sub>:** You import much of your rice, a staple of your diet; even so, you grow approximately 3% of the world's crop. You also raised some 4.6 million cattle in 1989.

**Chlorofluorocarbons CFCs:** You spend a great deal of money researching environmental problems, yet you use more than 10% of the annual global total of CFCs and you account for 16% of the emissions. (WORLD RESOURCES 1992-93, P. 345.) You are a major producer of high tech - computers, etc. - which use large quantities of CFCs.

**Accountability:** You are ranked No. 4 in the greenhouse index rank according to the IPCC. It is estimated that you contribute 4.7% of the total global emissions of greenhouse gases. (WORLD RESOURCES 1992-93, p. 208)

## GLOBAL CLIMATE CHANGE AND ACCOUNTABILITY - THE NETHERLANDS

### YOUR NATION and ATMOSPHERIC CONCENTRATIONS of GREENHOUSE GASES:

You have a high standard of living which means high levels of consumerism. It is important to note that you industrialized nations have only one quarter of the world's population, yet you consume 80 percent of the world's goods. (MacNeill, *Scientific American*, p. 156.) But you have become committed to sustainable development, development that does not further deplete resources from future generations.. With your geography and a well-educated population, you have become a leader in environmental concerns both in the global community and the European Community (EC, the 12 full members of the Common Market). You are one of the few nations meeting the U.N. suggested level of give 0.7 percent of your GNP as aid to developing nations. Review "Getting to Know You Nation." You need to be concerned about climate change.

**Carbon Dioxide CO<sub>2</sub>:** You own one of the world's largest oil companies, the Royal Dutch Shell. It operates one of Europe's largest oil refineries near Rotterdam and one of the world's largest in Curacao, a former Dutch colony in the West Indies. You also have one of the world's largest producing natural gas fields in your own land area; you have 1.7% of known world reserves.

Along with the rest of the European Community you support cutting taxes by 90% on biofuels to encourage commercial production and use of methanol, ethanol, and other plant-derived petroleum substitutes. Biofuels were being taxed at the same rate as fossil fuels. In addition to decreasing CO<sub>2</sub> emissions from transportation, biofuels create new opportunities for farmers. These fuels would decrease an estimated 25% of the total CO<sub>2</sub> emissions from the European Community (EC). (GLOBAL ENVIRONMENTAL CHANGE REPORT, February 29, 1992, p. 5). In 1988 there were 5.2 million passenger and 506 thousand commercial motor vehicles in use in your small country. However, you have 12 million bicycles for 15 million people which are used for personal travel. (STATE OF THE WORLD, p. 180)

You, along with other members of the European Community, are committed to using natural gas in new power plants. Somewhere between 50-60% of all new power plants being built in Europe are fueled with natural gas. This is a commitment to buy natural gas from Russia which means building state of the art pipelines.

**Methane CH<sub>4</sub>:** Waste reduction is a major problem in the Netherlands. By the year 2000 there will be a reduction of 10% of the amount determined to have been generated in the year 1986. 55% of the waste will be reused. Manufacturers will be made responsible for their products from 'cradle to grave' which means from raw material to waste material. Costs of dealing with the waste will be considered at the beginning of the production of the product and not at the end of the lifetime of the product. In the long run it will save on energy, raw materials, and land use. Besides, you believe that any growth in the GNP of industrialized nations in the next 20 to 25 years should be used to fund ecological survival. (JOURNAL OF THE AIR & WASTE MANAGEMENT ASSOCIATION, August 1991, pp. 1026-1027). There were 4.7 million cattle in 1988. You have begun reducing the size and number of livestock farms.

**Chlorofluorocarbons CFCs:** 99.5% of the use of CFCs will be banned by 1995. Moreover, there will be a total ban on the production and use of CFCs in 1997 at the latest. Along with Germany you have led the way in calling for early phaseout by the European Community of CFCs.

**Accountability:** You are ranked No. 34 in the greenhouse index rank according to the IPCC. It is estimated that you contribute 0.5% of the total global emissions of greenhouse gases. (WORLD RESOURCES 1992-93, p. 206). One important thing to note. You Dutch are stressing pollution avoidance as distinguished from pollution control to encourage development of 'clean' technologies.

## GLOBAL CLIMATE CHANGE AND ACCOUNTABILITY - NIGERIA

### YOUR NATION and ATMOSPHERIC CONCENTRATIONS of GREENHOUSE GASES:

Nigeria is one of the most populous countries in Africa. Many estimate that if current trends continue for the next 20 years, developing countries such as yours will consume as much energy as the developed or industrialized countries do now. Yet your standard of living will be even further behind than it is today. The problem is that energy is neither efficiently nor equally used. The rich in under-developed and developing countries consume energy like the industrialized nations. The poor, which makes up the majority of the population, use energy from human beings and draft animals for agriculture, transportation and domestic activities.

#### Carbon Dioxide CO<sub>2</sub>:

You are a member of OPEC (the Organization of Petroleum Exporting Countries). 95% of your export income is from petroleum. Therefore, when oil prices or a decline, your economy suffers. Debt payment eats up a large share of your national budget. It means you don't have the investment capital (money) needed for economic and human development. You certainly don't have it for environmental protection! Debt service obligations are so large (refer to "Getting to Know Your Nation") that most financial resources from exports and loans are flowing out of the country rather than into the country. When oil revenues fell in 1986 because prices fell, you had to cut oil production. This severely hurt your economic growth. And it slowed the progress you were trying to make toward diversifying or broadening your economy and making your revenues less dependent on petroleum exports.

It is estimated that you have 2.2% of the world reserves of natural gas. Your exports in natural gas have also declined.

The most recent statistics available for motor vehicle use in Nigeria was in 1981. You had 262,000 passenger and 90,000 commercial motor vehicles in use.

In terms of deforestation, your tropical forests are rapidly disappearing. You have cut down the forest to clear land for ranching and agriculture; to get wood for cooking; and to get lumber for building and material for paper industries. Your rural household energy comes from biomass often called traditional fuels [gathered fuelwood, dung (*animal excreta*), charcoal and crop residue]. Women and children gather twigs and branches for cooking fuel which helps to destroy forests. Cooking is the most energy-intensive activity of the poor in underdeveloped countries. This use of traditional fuels does not cause a net increase of CO<sub>2</sub> in the atmosphere. Therefore, the emissions from the burning of traditional fuels are not included in the numbers on the Source Table, p. 17. But deforestation does cause a net increase and remains an important source. (*Refer to the Source Table.*) Most of the 23% of global CO<sub>2</sub> emissions from deforestation comes from you developing countries.

Methane CH<sub>4</sub>: Nigeria had 12.1 million cattle in 1989. Because of your oil and gas production you are a significant emitter of CH<sub>4</sub>. (See the Source Table, p. 17.)

Chlorofluorocarbons CFCs: You are not a major contributor. High-tech industry, refrigeration and air-conditioning, etc. are not developed to any significant degree in your country.

Accountability: Nigeria ranks No. 18 in **greenhouse gas rank** according to the IPCC. It is estimated you contribute 1.1% of the **total global greenhouse gases**. Clearly, industrialized countries must stabilize their emissions of greenhouse gases. However, rapidly growing populations in underdeveloped countries will degrade the global atmosphere on their own when future fossil-fuel emissions and deforestation are considered. So you are accountable for the problem!

## **GLOBAL CLIMATE CHANGE AND ACCOUNTABILITY - RUSSIA - SOVIET UNION** **YOUR NATION and ATMOSPHERIC CONCENTRATIONS of GREENHOUSE GASES:**

Your economy is in transition. You would like to be designated as that and not developing like Brazil and China, etc. Even though the former Soviet Union no longer exists, representatives to the IPCC now represent Russia or CIS (Commonwealth of Independent States). You are still committed to playing a major role in working toward a global climate treaty. More and more you must be dependent on the industrialized, developed nations for investment capital.

**Carbon Dioxide CO<sub>2</sub>:** The CIS has abundant reserves of fossil fuels. You have 13% of the known coal reserves, approximately 6.6% of the estimated world's proven reserves of oil, and 38% of the proven reserves of natural gas. As your reserves are developed your CO<sub>2</sub> emissions will undoubtedly increase. As it is, you are the second largest source of CO<sub>2</sub>.

You were leading the world in petroleum production - oil and natural gas. These gas reserves are the largest in the world. But with changes in your economy this industry came close to collapsing during the political and economic turmoil of the 1990-91 period. But natural gas has emerged as the most important energy source in this region. Somewhere between 50-60% of all new power plants being built in Europe are fueled with natural gas. They have made a commitment to you to buy your natural gas. This could mean building 'state-of-the art' pipelines which means technological transfer which you want.

Even though nuclear energy does not release greenhouse gases, you are not at present building new nuclear reactors. The Chernobyl accident has caused you to think about other sources of energy. But you will continue to rely on nuclear in the future.

You have the potential for adding more greenhouse gases as your economy becomes more consumer-oriented. Motor vehicles in use in 1980 (*this is the only available statistic*) were 9.2 million passenger and 7.9 million commercial motor vehicles. In searching for alternatives to fossil fuels, the CIS is studying hydrogen for use in aviation; you already have experience in using it to power rockets.

You are a major source of forest products. Most of your forests lie beyond the Ural Mountains in the northeastern section of Siberia. Estimates are that the Siberia coniferous forests hold 40 billion tons of stored carbon, one-half of the amount stored in the Amazon basin. You have 25% of the world's reserves of forests. (*Nature*, p. 293 - 294)

**Methane CH<sub>4</sub>.** You are the world's third largest source in the total emissions of methane - 34 million metric tons. You are the largest emitter from gas production and transmission (35 %) and second (19%) only to China in emissions from coal production. If you do more extensive mining, you will certainly increase your emissions. (*WORLD RESOURCES 1992-93*, p. 345.) Your gas pipelines are notorious for leakage. You had 118 million cattle in 1989. Waste disposal has also been a problem; this causes you to be second in the world as this source of CH<sub>4</sub>.

**Chlorofluorocarbons CFCs:** You contribute about 14% of the total CFCs released into the atmosphere each year. Refrigeration accounts for the fastest-growing use of CFCs in the developing world. But in Russia high-tech industries such as electronics - computers, etc. use a lot of CFCs.

**Accountability:** You are ranked by the IPCC as No. 2 in the **greenhouse index rank**. It is estimated that you contribute 13.6% of the **total net emissions of greenhouse gases**. (*WORLD RESOURCES 1992-93*, p. 208)

**GLOBAL CLIMATE CHANGE AND ACCOUNTABILITY - SAUDI ARABIA**  
**YOUR NATION and ATMOSPHERIC CONCENTRATIONS of GREENHOUSE GASES:**

Because of the recent Gulf War you have assured the U.S. and the other industrialized nations that you will maintain low oil prices. You are a major importer of goods from the United States. You are a leading member of OPEC (Organization of Petroleum Exporting Countries). There are 26 major oil-exporting developing nations. Thirteen are members of OPEC; thirteen unaffiliated countries. You have great influence in setting world oil prices. Review your 'Getting to Know Your Nation' to consider how decisions are made within the country.

**Carbon Dioxide CO<sub>2</sub>:** Two-thirds of the world's proven reserves of oil are within the region in and around Saudi Arabia. Specifically, you have 18.8% of the known proven reserves. In terms of natural gas you have 3.7% of the proven reserves and there is probably more which will be found with better discovery technology. As it is, that is enough to last you over 900 years if used at the current rate you use your oil. (*STATE OF THE WORLD, 1992, P. 40*). All of this means that you are a major contributor to the CO<sub>2</sub> problem. Review your Source Table.

Motor vehicles in use in 1987 were 2.2 million passenger and 1.9 million commercial.

**Methane CH<sub>4</sub>:** Look at the Source Table. Notice where your methane emissions are coming from.

**Chlorofluorocarbons CFCs:** You have not signed the Montreal Protocol. You consider yourself a developing nation. Refrigeration accounts for the fastest-growing use of CFCs in the developing world, and clearly you must use air-conditioning in your area. CFCs are used in the computer industry. You opened the Exploration and Petroleum Engineering Center (EXPEC) in 1982 to perform sophisticated calculations to discover likely places for and performance of petroleum reserves. These state-of-the-art computer systems, purchased from U.S. computer companies, are cooled with freon (a CFC) refrigeration systems.

**Accountability:** You are ranked No. 30 in the **greenhouse gas index** according to the IPCC. It is estimated that you contribute 0.6% of the total global emissions of greenhouse gases. (*WORLD RESOURCES 1992-93, p. 208*)

## **GLOBAL CLIMATE CHANGE AND ACCOUNTABILITY - UNITED STATES**

### **YOUR NATION and ATMOSPHERIC CONCENTRATIONS of GREENHOUSE GASES:**

With less than 5% of the world's population, it is estimated that the U.S. consumes 30% of the world's resources in a given year. It is important to note that the industrialized nations have only one quarter of the world's population, yet they consume 80 percent of the world's goods. (MacNeill, *Scientific American*, p. 156.)

**Carbon Dioxide CO<sub>2</sub>:** The U.S. has about 12% of the known world reserves of coal. Coal accounts for more than 85% of potential U.S. fossil-fuel reserves. So policy makers are not willing to abandon it even though U.S. coal-fired power plants account for about 35% of U.S. CO<sub>2</sub> emissions (Blevins and Walzer, p. 104). Natural gas would produce about half as much CO<sub>2</sub>, and natural gas accounts for 10% of potential U.S. fossil-fuel reserves. But a switch to natural gas might risk making you more dependent on foreign suppliers as with oil.

From experience the U.S. knows that there are few technological fixes for reducing CO<sub>2</sub> caused by burning coal. The important point is utilities believe that the U.S. cannot afford to abandon your abundant coal resources altogether. "The cornerstone of U.S. energy policy is coal." (Corcoran, SA, May 1991, p.106-116) The simplest solution is to burn less or from the power plant perspective - to convince customers to use less electricity. The U.S. is already spending 2% of GNP or \$115 billion annually on pollution control.

The Depart. of Energy and the Solar Energy Research Institute in Golden, Colo. are trying to use microalgae to convert the CO<sub>2</sub> into biomass, liquefy it, then use the product as transportation fuel. You have investigated widespread use of biomass fuels, but you are concerned about the size of the land area required to produce them. Your analysts estimate that biomass fuels would provide no more than 20-30% of the energy currently used for transportation. You could convert farms and forests. But they, of course, absorb CO<sub>2</sub>.

To maintain a high standard of living, Americans use more energy than any other nation. You have the highest per capita automobile use in the world. There were 141 million passenger and 40 million commercial motor vehicles in use in 1988. The U.S. Office of Technology and Assessment estimated in April 1991 that it is impossible to make substantial cuts in CO<sub>2</sub> emissions without sacrificing comfort and convenience. Many view cutbacks as "anti-growth" in a time of recession.

U.S. is the largest producer of forest products in the world and the second largest exporter of raw timber (WR 92-93, p. 24.) A recent study found that only 44% of the world's temperate rainforest remains; it is mostly along the Pacific coast of North America. Of the old-growth, only 10-15% remains. The U.S. has taken steps to restrict wood imports to help deforestation in developing countries. Debt for nature swaps have been adopted by the U.S. government. It passed a bill in 1990 to help the burden in Latin American. Nearly a \$7 billion will be reduced. Much of it will go for environmental programs chosen by the debtor nation. (WORLD RESOURCES 1992-93, p. 123)

**Methane CH<sub>4</sub>:** A by-product of your consumption is a tremendous problem with waste disposal and landfills. Many of your imported resources and products originate in deforested areas around the world. You lead in emissions in methane - 37% of the total - from solid waste disposal. In 1988 you raised 98 million cattle; this number is down from 104.5 million in 1986.

### **Chlorofluorocarbons CFCs:**

The U.S. emitted 22% of the emissions in 1989, but the U.S. has proposed a complete ban by 1995. President Bush announced on February 11, 1992, that the U.S. will halt production of CFCs by Dec 31, 1995. He has asked producers to cut 1992 CFC production to 50% of 1986 levels an 8% decrease from current production. (WORLD RESOURCES 1992-93, pp 22-23).

**Accountability:** You are ranked as No. 1 in the world in greenhouse gas emissions (greenhouse index rank). It is estimated that you contribute 17.8% of the total net emissions of greenhouse gases. (WORLD RESOURCES 1992-93, p. 208)

## A SIMULATION: THE INTERGOVERNMENTAL NEGOTIATING COMMITTEE for a GLOBAL TREATY ON CLIMATE CHANGE

You will be participating in a simulation of the United Nations Intergovernmental Panel on Climate Change (IPCC). You will be playing the role of members/negotiators of the Intergovernmental Negotiating Committee (INC) representing ten nations. As negotiators your task will be to work on an "effective" treaty on climate change with the means for nations to make "appropriate commitments."

You will be negotiating the following issues:

1. **Adoption of Targets and Timetables.** *(A target means stabilizing or reducing greenhouse gases at specific levels. Timetables mean reduction or stabilizing by specific years.)*
2. **Adoption of Individual National Plans.** *(An individual national plan is the means or mechanisms each nation chooses to meet these targets and timetables.)* You should consider and include any of the following means in your negotiations. Even though the plan is for your nation it may require the assistance of other nations. Think about sustainable development.

### Stabilizing or Reducing:

**CO<sub>2</sub>** - Using Carbon tax. Tax on fuels with high concentrations of carbon to discourage their use.  
Changing Fuel mixtures. A move to rely on cleaner burning fuels such as natural gas, biomass for ethanol and methanol, hydro, and nuclear power as transitional energy sources. In the future greater reliance on alternative energy sources (solar, wind, geothermal, hydrogen, fusion, etc.).

Limiting further deforestation. Logging and forest management that reflect all costs. Trees store carbon. For developing nations, 'debt for nature' swaps. This means creditor nations forgiving the debt in exchange for the debtor nation preserving forests. Finding other uses for forest products that will not require cutting (*nuts, plants for medicines, rubber, syrups, etc.*)

**CH<sub>4</sub>** - Controlling natural gas pipeline leakage.  
Capturing gas from coal mines instead of venting.

**CFCs** - Phasing out in accordance with the 1987 Montreal Protocol. Requires nations to cut consumption by 20% of the 1986-level by the year 1994, and 50% of the 1986-level by 1999. There will be allowances for increases in consumption by developing nations.  
Providing incentives for the development of less harmful alternatives.

**Population Growth:** Controlling population growth allows developing and underdeveloped nations to better provide for a quality of life or higher standard of living for their citizens.

3. **Financial Assistance:** Providing funds for assisting developing and underdeveloped nations makes it possible for them to carry out their national plans. It has been recommended that the developed nations contribute 0.7% of their GNP to a fund to be used for purchasing technical advice, assistance, debt, etc.
4. **Technological Transfer:** Sharing advanced technology with developing and underdeveloped nations enables them to achieve a higher standard of living for their citizens at lower energy costs and greenhouse gas emissions.

The preceding issues are based on the report of the United Nations IPCC Scientific Assessment Panel. It has stated that:

- o If the world continues to emit greenhouse gases at present levels, "business as usual," the average global temperatures will rise at the rate of 0.3° C or .54° F per decade based on current computer models. *(This means by the year 2025 the Earth will on the average be 1° C or 1.8° F warmer. Before the end of the next century the Earth will be 3° C or 5.4° F warmer.)*
- o Continued emissions of such gases at present rates would commit us to increased concentrations for centuries ahead. *(There is at present no understanding of what that may mean to life on Earth as we now know it.)*
- o To stabilize atmospheric concentrations of CO<sub>2</sub> and CFCs at today's levels would require immediate reductions in emissions from human activities of over 60%; methane would require a 15-20% reduction.

#### INSTRUCTIONS FOR SIMULATION:

It is important to remember that your goal is to get some kind of agreement for controlling the greenhouse gases going into the atmosphere. Also remember that you are negotiating an agreement or treaty that is binding on the parties that enter into the agreement and sign it. Historically, once a nation ratifies a treaty it will most likely live by its provisions. But if it does not, there are limited ways in which the other nations can enforce the treaty. That means that it is important to find areas where you can willingly agree. Where there is reluctance to abide by a provision, it is better to back off. The idea is to go as far as you can in achieving some kind of control on the greenhouse gases going into the atmosphere. The underlying belief is that some kind of reduction in emissions is better than none at all. And it must be followed by the greatest number of signatories as possible. *(Signatory is the name for a party signing the treaty.)* Then perhaps it can be strengthened in the future.

#### **AS MEMBERS OF YOUR NATION:**

1. Individually read the issues carefully. Discuss each part as a group to make sure that each member understands the issues. Since each member is a negotiator, he/she will be talking with other nations on your behalf. Therefore, it is to the benefit of your nation to have each member understand.
2. Then read Your Negotiating Position. Determine what your nation wants. Consider what your nation absolutely cannot do, what it can possibly do, and what it will do on each of the four issues. Think about how it will affect your economy, society, political institutions, and national reputation.
  - a. Targets and Timetables
  - b. Your National Plan
  - c. Financial Assistance
  - d. Technological Transfer

#### **AS INC NEGOTIATORS:**

3. Have a member of each group be prepared to go to the negotiating table where that issue is being discussed. That member will represent your position in trying to reach consensus. That group will then write the provision if agreement is reached.

**YOUR NEGOTIATING POSITION: BANGLADESH**

You are entering the negotiating process as an impoverished nation that seems to have lost control of its destiny. You see the buildup of greenhouse gases as a major problem that could affect you tremendously. However, you now see that this is mainly the responsibility of the developed nations. They are the ones who have contributed to the problem.

**1. ADOPTION OF TARGETS AND TIMETABLES:**

You think that the developed nations should stabilize or reduce their greenhouse gas emissions as soon as possible. With your growing population and low standard of living, you cannot possibly reduce your emissions.

**2. INDIVIDUAL NATIONAL PLANS:**

**Carbon Dioxide:**

**Carbon Tax:** You feel that at your present rate of usage, a carbon tax is unnecessary.

**Changing Fuel Mixtures:** With financial aid and access to better technology, you could increase your use of natural gas.

**Limiting Further Deforestation:** Since you have already cleared a good portion of your territory, this will not be a major problem in the future!

**Methane:** Since you have such a large population to feed, you cannot realistically lower methane emissions from your agriculture. You could prevent further emissions from pipe lines and coal mines in the future if developed nations could help you with technology.

**CFCs:** In order to use more refrigeration and otherwise raise your standard of living, you either need to use CFCs or receive substitutes and new technology from the developed nations. You have signed the Montreal Protocol.

**Population Control:** You realize that this is a problem that is keeping you from raising your standard of living. You have already lowered your fertility rate to 4.9 children per family and hope to lower it further to 2.3 by 2000. Any help from the developed nations in the educational process would be welcomed.

**3. FINANCIAL ASSISTANCE:** You must have help from the developed nations. Push hard for major contributions to a fund to help poorer countries such as yours. They should each contribute at least 0.7% of their GNP to an assistance fund.

**4. TECHNOLOGICAL TRANSFER:** You would love to avoid the mistakes of the developed nations in your path toward modernization. If you could achieve a higher standard of living without the use of polluting fossil fuels, you would. Let the developed nations know you need their help and you can't afford to buy it.

## **YOUR NEGOTIATING POSITION: BRAZIL**

You are entering the negotiating session as a nation that is realizing the mistakes of the past and is anxious to take its place in the world community as a developing nation and world leader. You have great potential for economic development but have to solve problems with poverty in your nation and debt to other nations.

**1. ADOPTION OF TARGETS AND TIMETABLES:** You are willing to be part of an agreement to lower greenhouse gas emissions within a certain time frame. However, you will need help from the rest of the world community to accomplish your own reductions. The amount that you can cut your emissions and how soon you can do so depends on the cooperation of other nations.

## **2. INDIVIDUAL NATIONAL PLAN:**

### **Carbon Dioxide:**

**Carbon Tax:** To reduce emissions from CO<sub>2</sub>, most of your savings could come from slowing the rate of deforestation. You could consider a carbon tax on imported fossil fuels. This would make your ethanol fuel even more competitively priced.

**Changing Fuel Mixtures:** Since you have no large deposits of fossil fuels in your nation, you are already ahead of other nations in changing your fuel mix. You have built huge dams for hydropower and have invested in agriculture-based fuels. You also use some nuclear power.

**Limiting Further Deforestation:** This is a complicated issue for your nation. In recent years you have made an effort to slow deforestation by ending government subsidies and setting aside areas of the rainforest as preserves and national parks. However, there is still poverty and an uneven distribution of wealth and land ownership. With assistance from the developed countries, you could further educate your citizens on other uses of the forest and provide police to stop illegal burning and cutting. Be sure to point out to other nations that it is not you alone that is responsible for deforestation. It is the temperate forests as well as the tropical forests that store the carbon. Nations such as the United States have cut large areas of their forests in the past and are still doing so today.

**Methane:** Since you do not have large deposits of fossil fuels and depend on your agriculture for exports and to feed your people, there are probably no large savings in this area that would be easily achieved.

**CFCs:** You agreed to the Montreal Protocol. You would be happy to convert your use of CFCs in your industry if the developed nations would provide you with substitute gases. You do not have the money to develop your own at this time.

**Population Control:** You realize that your population growth in the past has added to your poverty rates. You have started effective birth control programs. 66% of Brazilian women are now using contraceptives. By 1992, your population growth rate is down to 1.9%.

**3. FINANCIAL ASSISTANCE:** You need help in solving your debt problems. In order to pay for your massive debt, you have had to rely on timber and other exports just to pay the interest. You have had to ignore your poverty problems since you pay so much. If you could get some relief from the debt, it would help you to meet your national plan. Suggest to other nations that if you had help, you might be able to set aside more of the forests as preserves (debt for nature swaps). The developed nations that have built their prosperity on the use of fossil fuels in the past have contributed to the problems that we have today. They should give part of their wealth to a fund to help other nations solve their problems.

**4. TECHNOLOGICAL TRANSFER:** Any technology that would help you to be more fuel efficient in generating electricity or to be able to use other alternative fuels would be welcome. With your debts to other nations such a burden already, you could not afford to buy this technology.

## **YOUR NEGOTIATING POSITION: CHINA**

You are entering this negotiating session as the nation with the largest human population and therefore you have the potential of becoming the largest source of greenhouse gases in the future. Your reliance on coal to fuel your rise in standard of living for your large population has many other nations concerned.

### **1. ADOPTION OF TARGETS AND TIMETABLES:**

You would support a specific target and timetable for stabilizing or reducing greenhouse gases only if there are exceptions made for the developing nations such as yours. You need to be able to raise your standard of living and at this time need to use your coal until other sources of energy are found.

### **2. INDIVIDUAL NATIONAL PLAN:**

#### **Carbon Dioxide:**

**Carbon Tax:** At this point, you could not support a carbon tax for your nation since it would tax most heavily your chief source of energy, coal.

**Changing Fuel Mixtures:** You cannot afford to change your fuel mixture alone. However, if other nations will help you with technology and financial aid, you could develop your hydropower and find more natural gas. You might also be able to trade for natural gas with your neighbor, Russia. Your scientists are working to develop alternative fuel sources.

**Limiting Further Deforestation:** Since you have already cleared much of your potential agricultural land, deforestation is not a great problem for you. Other nations could be pressured however to slow their deforestation to lessen total greenhouse gas buildup.

**Methane:** Since you have such a large population to feed, you cannot realistically lower your methane emissions from your agriculture. However, with technological and financial help from the developed nations, you could lower your emissions from your coal mines.

**CFCs:** You have indicated that you will sign the Montreal Protocol if there is a provision that there will be a fund for the developing nations to use to finance a switch to CFC substitutes. You appear to be close to finding alternative methods of refrigeration that do not use CFC's. This could reduce your total emissions. Your research success could also help other developing and underdeveloped nations.

**Population Control:** You realize that this is a big problem and you have been a leader among the nations in controlling your growth rate. You have lowered your birth rate to 2.3 children per family, lower than most developing nations.

**3. FINANCIAL ASSISTANCE:** The developed nations must accept responsibility for the greenhouse gas buildup in the atmosphere. They built their prosperity on the use of cheap fossil fuels. Now they need to share some of the wealth so that you can avoid their mistakes in raising your standard of living. You have no choice but to use your coal. You have 50% of the world's reserves of coal; it is cheap and easily obtained. You would welcome financial assistance in modernizing your power plants. Push for contributions from the developed nations. It has been suggested that they make contributions equal to 0.7% of their GNP.

**4. TECHNOLOGICAL TRANSFER:** Even though your scientists are hard at work searching for solutions, you could make greater progress if there was more technological transfer. You need help if you are to stabilize your gas emissions. Much of your power and industry are very inefficient in burning coal. The developed nations have the technology to help you.

## **YOUR NEGOTIATING POSITION: JAPAN**

Because of your wealth and international trade, you are very influential and have an important role in these negotiations. You agree that something must be done to lower greenhouse gas emissions and support the negotiations that are about to take place.

### **1. ADOPTION OF TARGETS AND TIMETABLES:**

Japan has called for all industrialized nations to make a "best effort" to stabilize greenhouse gas emissions at 1990 levels. Your position is in between the positions of the United States and the positions of the European nations.

### **2. INDIVIDUAL NATIONAL PLAN::**

#### **Carbon Dioxide:**

**Carbon Tax:** You would be willing to consider a carbon tax if other developed nations such as the United States adopt it. You already have considerably higher fuel prices than many and you have taken many steps to make your industries fuel efficient. Since you must remain competitive in world trade, you feel that all developed nations should raise their fossil fuel prices to encourage alternative energy sources.

**Changing Fuel Mixtures:** Since you import almost all of your fossil fuels, you have invested heavily in efficient power plants. You are relying more on nuclear power and are researching alternative energy sources such as geothermal and fusion.

**Limiting Further Deforestation:** You are very protective of your own forests, but buy huge quantities of wood from other nations such as Indonesia, Malaysia, Brazil and the United States. You believe that deforestation is a problem but that it is the problem of other nations. They are earning their money by harvesting their timber; you will trade with them - timber for industrial goods.

**Methane:** Since you import much of your rice and your fossil fuels, you do not consider this a problem that you can do too much about.

**CFCs.** You have signed the Montreal Protocol and support a speeding up of the phasing out of CFCs. Your industry is hard at work searching for substitutes for CFCs.

**Population Control:** Since your population is very slow growing, this is not a problem for you. Other nations, however, should act to limit growth. Perhaps you could be of assistance.

**3. FINANCIAL ASSISTANCE:** You are already the largest donor of financial aid to developing and underdeveloped nations. You support the creation of a fund to help other nations stabilize their emissions of greenhouse gases as long as all developed nations contribute.

**4. TECHNOLOGICAL TRANSFER:** You have long supported technological transfer and feel that your industries could help to solve many problems if developing nations would buy your technology.

## **YOUR NEGOTIATING POSITION: GERMANY**

You are a wealthy, developed nation with a great deal of influence. You believe that there is a problem with greenhouse gas emissions and that it is the responsibility of developed nations to find solutions. You feel that the European nations, which have seen the results of industrial pollution and dense populations should convince the rest of the world to act quickly to lessen the potential for climate change. One of the leaders of the European Community, Mr. Laurens Jan Brinkhorst, recently stated, "Environmental leadership is no longer with the U.S."

### **1. ADOPTION OF TARGETS AND TIMETABLES:**

You have already committed your nation to a 25% reduction in CO<sub>2</sub> emissions by 2005. Germany, along with the Netherlands, is pushing for similar reductions among all industrialized nations.

### **2. YOUR NATIONAL PLAN:**

#### **Carbon Dioxide:**

**Carbon Tax:** You support the idea of a carbon tax and have already begun a plan to start one in your nation and the rest of the European Community. This will tax fuels with the highest carbon content per heating unit. You need to convince the United States that they must pass such a tax also. They have the lowest fuel prices of any developed nation. This discourages conservation and alternative energy sources.

**Changing Fuel Mixtures:** The industries and power plants in the former East Germany are very inefficient and highly polluting. Now that you have re-united your nation, you are spending huge sums of money to make them more efficient. You are also switching away from coal to cleaner burning fuels. You are buying more natural gas from Russia. You are largest source of wind generated electricity and are researching many alternative fuel sources.

**Limiting Further Deforestation:** Try to convince other nations of the world of the importance of slowing deforestation. Remember that you have already stopped using tropical timber. Slowing deforestation would slow the build up of carbon dioxide in the atmosphere considerably.

**Methane:** As you improve the technology in fossil fuel production (pipeline leakage and coal mining, ) you should be able to lower your emissions of methane. Ask other nations to follow your lead.

**CFCs:** You have signed the Montreal Protocol and would like to speed up the phase out of CFCs.

**Population Control:** Your population is actually shrinking. This is a problem that other nations must face, especially the developing nations. Pressure others to take steps to slow population growth.

**3. FINANCIAL ASSISTANCE:** You believe that you have a responsibility to help the rest of the nations of the world. You would be willing to contribute to a fund to offer financial assistance. However, the re-unification of your nation has proved more costly than you had expected. You are not sure if you could commit 0.7% of your GNP as some governments are suggesting. Since you are lowering your own emissions considerably, other nations could contribute more money. But, be flexible on this issue.

**4. TECHNOLOGICAL TRANSFER:** You are convinced that this is a very important issue. The United States is concerned that patents be respected and that companies be paid for their research and development. Suggest to the negotiating committee that companies that have patents for technologies that are going to slow greenhouse gas emissions be bought using the fund that may be set up to provide financial assistance.

## **YOUR NEGOTIATING POSITION: NETHERLANDS**

You have become a vocal advocate of strong actions to slow the build-up of greenhouse gases in the atmosphere. You have taken actions that few other nations have been willing to take to find solutions. Your government and most of your people are strong believers in the concept of sustainable growth. You think that all nations must begin to think in these terms so that future generations can enjoy a high standard of living. The costs to the environment must be considered. We must use today's resources in a way that guarantees that they will still exist for the use of future generations in achieving the same standard of living that we enjoy.

### **1. ADOPTION OF TARGETS AND TIMETABLES:**

The Netherlands has already adopted measures to reduce its emissions of greenhouse gases. You have set the target of reducing your carbon emissions by 3-5% by the year 2000. You are willing to negotiate deeper cuts and feel strongly that all developed nations must cut their emissions. The European Community, of which you are a member, has called for a 25% CO<sub>2</sub> reduction by 2005.

### **2. YOUR NATIONAL PLAN:**

#### **Carbon Dioxide:**

**Carbon Tax:** You support the introduction of carbon fees in all developed nations to provide incentives to use fuels with lower or no carbon content. You have already instituted carbon taxes in the Netherlands without waiting for other nations to consider them. Try to convince others of the importance of the carbon taxes.

**Changing Fuel Mixtures:** You are relying more on natural gas for your fossil fuel needs. You are also developing alternative fuels as part of your commitment to reduce carbon emissions.

**Limiting Further Deforestation:** You are concerned about the destruction of forests worldwide. If this could be controlled, it would have a significant effect on slowing climatic change. Try to pressure other nations such as Brazil and the United States to control deforestation. Point out to Japan its role. That nation buys huge quantities of timber, much of which is used in plywood and cardboard that is later discarded. Also point out to the United States that it is the largest consuming nation. Both Japan and the United States are indirectly participating in global deforestation.

**Methane:** With your technology, wealth and commitment to finding solutions to the problem of greenhouse gas emissions, you might be able to help others. Your large petroleum and natural gas industry has investments around the world. You could share some of your expertise and help developing nations to reduce CH<sub>4</sub> emissions in their fossil fuel production (leaking gas pipelines, coal mines, etc.).

**CFCs:** You have signed the Montreal Protocol and are in favor of speeding up the phase out of these gases. See if you can encourage other nations to share their technological research findings to help solve the problem.

**Population Growth:** You realize that if the growth in population is not slowed efforts to decrease greenhouse gas emissions will have been in vain. Try to convince all nations that population control programs are essential.

**3. FINANCIAL ASSISTANCE:** You are one of only a handful of nations that have committed the recommended amount of financial assistance to developing nations, 0.7% of your GNP. Try to encourage other nations to commit a set amount (% of their GNP) to a fund to solve some of the problems that the global community is facing. The fund could be used for many purposes such as technological transfer, raising the standard of living of developing and underdeveloped nations, easing the debt burdens of the poorer nations, population control and other issues that are indirectly contributing to excess greenhouse gas emissions.

**4. TECHNOLOGICAL TRANSFER:** As a very concerned nation, try to find a solution to the issues that might block technological transfer. Some nations such as the United States are concerned that patents will not be respected. Companies that invest heavily in developing technology must be rewarded for their efforts. Patents could be bought from funds you are urging nations to set up to solve problems such as these.

## **YOUR NEGOTIATING POSITION: NIGERIA**

You are one of the leading African nations and a member of OPEC (Organization of Petroleum Exporting Countries). However, you are still a poor developing nation. Your policy on many issues therefore is often the result of many conflicting ideas and interests.

### **1. ADOPTION OF TARGETS AND TIMETABLES:**

You are aware that your nation could suffer from the effects of climate change. OPEC is against any global treaty that sets targets and timetables for slowing emissions. Since 95% of your exports are petroleum products, a major source of greenhouse gases, you are dealing with a sensitive issue. You would like to diversify your economy so that you are not as reliant on petroleum.

### **2. YOUR NATIONAL PLAN:**

#### **Carbon Dioxide:**

**Carbon Taxes:** Your people are poor and your economy is not strong. You do not feel that you could enact carbon taxes at this time. You would probably not be opposed if the developed nations taxed carbon fuels as long as it did not hurt your exports of petroleum. Remember that it is coal that has the highest carbon content per heating unit. If all nations would use petroleum and natural gas, instead of coal, the problem would be manageable and your economy strengthened!

**Changing Fuel Mixtures:** Nigeria has 2.2% of the world's proven reserves of natural gas with the potential of much more in off-shore fields. You could use this resource to lower your emissions if you had financial assistance and the technology to use this gas for more purposes. You could also export more natural gas.

**Limiting Further Deforestation:** Your rapidly expanding population and troubled economy has put pressure on your forested lands. As the forests are cut and burned, you are emitting major quantities of CO<sub>2</sub>. You are beginning to realize that this is a problem for you and the global community. However, you should remind the United States and Russia that the temperate forests in their territories are also being cut and that deforestation is a worldwide problem.

**Methane:** Since the majority of your methane comes from oil and gas production, you could take steps to lower the emissions. However, you need help in technology and financial assistance.

**CFCs:** You have signed the Montreal Protocol.

**Population Growth:** You are attempting to slow your high rate of growth. Any help from the developed nations would be welcome.

**3. TECHNOLOGICAL TRANSFER:** You would like to have access to better technology, especially to make your oil and gas production more efficient. Push for a speed-up of international technological transfer.

**4. FINANCIAL ASSISTANCE:** Even though you are a member of OPEC and have rich natural resources, you are still a poor developing nation. Assistance from the developed world could help you avoid some of their past mistakes in using fossil fuels inefficiently.

## **YOUR NEGOTIATING POSITION: RUSSIA**

At this time you are preoccupied with the major changes that have taken place in your nation. You are struggling to change to a free market economy and your standard of living has fallen in recent years. However, your potential for the future is great. You have large quantities of natural resources and an educated population.

### **1. ADOPTION OF TARGETS AND TIMETABLES:**

You are still committed to slowing emissions of greenhouse gases. However, since your economy is "in transition" you are asking for a delay of ten years in meeting any specific targets or timetables.

### **2. INDIVIDUAL NATIONAL PLANS:**

#### **Carbon Dioxide:**

**Carbon Taxes:** You have recently raised the price of all of your fuels. You might be able to experiment with various carbon taxes in the future, but you have to be very careful not to shock your economy any more than you have. Since your energy production and use has already fallen considerably because of the economic chaos, you should consider this issue in the future.

**Changing Fuel Mixtures:** You have abundant supplies of natural gas, the cleanest burning fossil fuel. With better technology and investment, you could produce vast quantities. This would not only help lower your emissions of CO<sub>2</sub>, but could also be a source of revenue for you if you exported more natural gas to other nations. At this time, you do not have the money to change your fuel mixture. With help from others, you might. You can't do it alone!

**Limiting Further Deforestation:** With 25% of the world's forests, you could experience more deforestation in the future. Japan is interested in buying timber from you. You need the money! You are caught in between a desire to preserve your forests and your financial bind.

**Methane:** You are a major source of methane gas. There is not much you can do about this without help from other nations. A source of methane that could be reduced is from your natural gas pipeline network. It is notoriously poor. The pipelines leak major quantities of methane into the atmosphere. You need financial assistance and technology to help you correct this problem.

**CFCs:** You have signed the Montreal Protocol. If other nations would give you substitutes for CFCs and the financial assistance to help you convert your industries for their use, you would be glad to agree to speed up the timetable for phasing out these gases, but you can do little on your own at this time.

**Population Growth:** Your population is not growing. You realize that population growth in the developing and underdeveloped nations is a threat to the future and you would support programs that might lead to population stabilization. You have no money to support these programs, however.

**3. FINANCIAL ASSISTANCE:** You need the financial assistance of other nations if you are to stabilize or reduce greenhouse gas emissions. You used to provide large sums of money to nations around the world, now you are in need of assistance.

**4. Technological Transfer:** Even though you are a leader in scientific research and many nations are using and buying your technology, you need help in becoming more fuel efficient.

## **YOUR NEGOTIATING POSITION: SAUDI ARABIA**

You are very rich in natural resources and export petroleum around the world. You are a leading nation in OPEC (Organization of Petroleum Exporting Countries) and depend on petroleum exports for your national wealth. OPEC has said publicly that they do not support a treaty that would set targets and timetables to stabilize or reduce greenhouse gas emissions. Another OPEC member, Nigeria, is also in this negotiating session.

### **1. ADOPTION OF TARGETS AND TIMETABLES:**

Not taking a position.

### **2. INDIVIDUAL NATIONAL PLANS:**

#### **Carbon Dioxide:**

**Carbon Taxes:** Since you do not agree that there is conclusive scientific evidence supporting global climate change, you do not think that nations should have carbon taxes that would reduce consumption of fossil fuels. The world's economy is built on fossil fuels and a rapid change away from them would send us into economic depression.

**Changing Fuel Mixtures:** You have good reserves of natural gas and could use and export more of it as the demand rises. However, you do not see any reason for nations of the world to quickly change their fuel mixtures.

**Limiting Further Deforestation:** You agree that nations of the world should slow deforestation. Urge other nations to take actions.

**Methane:** You could lower your methane emissions from your natural gas pipelines and perhaps help others to do this also.

**CFCs:** You have not signed the Montreal Protocol that phases out CFC use.

**Population Control:** You have a rapidly growing population, but you do not see this as a problem. You are a wealthy nation and can provide for increases in your population.

**3. FINANCIAL ASSISTANCE:** You have given financial assistance to various nations in the past and are willing to continue in the future. However, you want to make sure that you know how this financial assistance would be used. Therefore, you would want specifics before you could agree to a fund to help underdeveloped and developing nations.

**4. TECHNOLOGICAL TRANSFER:** You are not taking a position on this issue.

## **YOUR NEGOTIATING POSITION: UNITED STATES**

You are entering this negotiation session as one of the richest and most powerful nations on the Earth. You depend on the use of fossil fuels for your economic prosperity. You are sensitive to the verbal attacks of other nations of the world concerning your energy and natural resource use. You are concerned about the global environment, but your government is not yet convinced that there is sufficient scientific evidence of potential climate change to warrant drastic, expensive actions. You have experienced the harmful economic effects of rapidly rising energy prices in the past, and you do not want to see this repeated. Recently your nation has had financial difficulties and your government is very sensitive to any actions that might cause further unemployment or changes in the economy. Your large scientific research community is devoting time and resources to the search for alternative fuels. Once there is a breakthrough in using hydrogen or fusion as energy sources, the world will not be dependent on fossil fuels. You have been a leader in pushing for a treaty to phase out CFC use.

### **1. ADOPTION OF SPECIFIC TARGETS AND TIMETABLES:**

At the present time you cannot accept specific targets and timetables. The costs of achieving such targets could be quite high and the benefits could be small and temporary. Once all of the scientific evidence is gathered and studied, you will consider taking further actions.

### **2. YOUR NATIONAL PLAN:**

#### **Carbon Dioxide:**

**Carbon Tax:** This idea has been suggested by many politicians. Opinion polls seem to indicate that most people would support actions to lessen the threat of global climate change, but most would be against higher fuel prices. Therefore, your government has been reluctant to enact carbon taxes.

**Changing Fuel Mixtures:** The U.S. has large reserves of both coal and natural gas. There has been considerable controversy concerning the use of different energy sources. Various industries and political action groups have called for various energy policies. The result? No national energy policy has been enacted. There has been some move toward using more natural gas in recent years.

**Limiting Further Deforestation:** Your government and various other groups have called for slowing further deforestation, especially in the tropics. This action, together with planting trees in the deforested areas, would slow further build-up of greenhouse gases. Your role in the global deforestation process however, is a subject of great debate in the United States.

**Methane:** You are taking steps to reduce the amount of solid waste, a major source of methane in your nation. You are also researching technology that would reduce methane emissions in fossil fuel production.

**CFCs:** Although you are the world's largest user of CFCs, you have been a leader in the treaty negotiations to phase out these gases. Scientific evidence demonstrates that they are responsible for damaging the protective ozone layer. Not only have you signed the Montreal Protocol, but you have recently announced a speed-up in timetables for a phase out. Research is continuing in finding an inexpensive, less harmful substitute. You feel that any global treaty on reducing greenhouse gas concentrations should take into account your actions in halting production of the most damaging of these gases by 1995.

**Population Growth:** Although you see this as a potential problem in the future, your government is very sensitive to the debate on abortion. At this time, you favor steps that nations are taking to slow population growth only if they do not include abortion.

**3. FINANCIAL ASSISTANCE:** You have always been generous in your aid programs to other nations. However, you have recently experienced, however, financial problems of your own and have cut back on aid programs. You now spend only 0.2% of your GNP on aid to other nations. Your government feels that at the present time, you cannot commit large sums of money to a fund that would help other nations slow their emissions. **4. TECHNOLOGICAL TRANSFER:** You are a leader in the development of technology and you would like to see this technology used to solve problems around the world. However, you are concerned that patent rights will not be respected. Many of your large corporations have spent vast sums of money developing new technologies and they need to be paid for their time and effort. Technology can be transferred only if all patents are respected.

## POSTSCRIPT and UPDATE 1996

### **POSTSCRIPT**

#### **The Rio Summit, June 1992**

The Rio Summit was an historic gathering. Never before in history had so many heads of state, representing 98% of the Earth's population, come together out of concern for the health of our planet Earth. The United Nations Earth Summit debated what was called **AGENDA 21**, a global plan to face up to the economic and ecological problems of the late 20th century and to seek global cooperation in finding solutions. Within the **Agenda 21** was the Framework Convention on Climate Change. (*A convention is a treaty and is legally binding under international law.*)

The Convention required industrialized nations to commit to reducing their carbon dioxide emissions to 1990 levels by the year 2000. The industrialized nations were pressured to admit that much of the CO<sub>2</sub> problem resulted from the way they consumed energy. (*They make up 25% of the world population, yet consume 70% of the world's energy, relying heavily on an unsustainable energy source - fossil fuels.*)

The actual positions of the nations were very close to those in the simulation. The United States' official policy was to slow down the whole process, lagging behind the European Community leadership, but to take the leading role in the phasing out of CFCs. Saudi Arabia, China and Nigeria were reluctant to sign the Convention on Climate Change since their economies are heavily based on fossil fuels. It is important to understand that many nations sign conventions without a real commitment or means to follow or observe its conditions. The U.S., however, will not sign without the political will and ability to carrying out the provisions.

Ultimately, 127 nations signed the Convention on Climate Change. It stated that "there is global scientific consensus that increased concentrations of greenhouse gases will lead to an overall global warming." To put the following numbers in perspective, keep in mind that scientists estimate that the Earth's average surface temperature has warmed by 5-9°F since the peak of the last ice age, some 18,000 years ago. In the last century, Earth's average surface temperature has risen by about 1°F. In anticipating a doubling of CO<sub>2</sub> between 1992 and 2050, the IPCC projections were for an additional rise of about 3-9°F (1.5-5°C) in surface temperatures. (*Sitarz, p. 142*) Happily, the IPCC projections in 1995 were more optimistic. (*See p. 43*)

Polar regions would be particularly impacted with the raising of sea levels to not quite 1 ft. to over 1.5 ft. by the year 2050 (0.3-0.5 meters) and by over 3 ft. (1 meter) by 2100. Miami, Florida, lies an average of 12 ft. above sea level which means some areas are already at sea level. The Netherlands has over one half of its land area below sea level. Over one half of the world's population lives less than four miles from the sea, some right at sea level.

#### **Scientists' Warning to Mankind, 1993**

In the Spring of 1993, over 1600 scientists signed a *World Scientists' Warning to Humanity* sponsored by the Union of Concerned Scientists.

*"We the undersigned, senior members of the world's scientific community, hereby warn all humanity of what lies ahead. A great change in our stewardship of the earth and the life on it is required, if vast human misery is to be avoided and our global home on this planet is not to be irretrievably mutilated."*

These scientists represented 69 nations which included the 19 largest economic powers and 12 of the most populous. Among the signers were 101 Nobel Laureates representing a majority of the living recipients of the prize in the sciences.

Mistakes made by one generation are often not recognized as such until many decades later. Later generations are then stuck with the cost of correcting them. We are living with mistakes begun in the industrial revolution. Because we are beginning to have the scientific understanding about global warming through organizations such as the IPCC, we have to be the ones to start correcting the problem.

To correct them, it may mean giving up certain practices now to insure our well being in the future. It will most certainly require our understanding of the technical debate of global climate change in order to participate in the forming of public policy. Too often, however, the public is left out of these debates because it does not or will not take time to understand and to make recommendations to the governmental policy-makers. The attitude is, "Leave it to the experts." But one of the world's leading experts on global warming, Dr. Stephen Schneider, makes this plea to us citizens:

"Just because an issue is complicated and involves technical debate, it does not mean the public is unqualified to participate in the policy-making process. On the contrary, if people learn what kinds of questions to ask experts, then not only can they participate more effectively in the democratic process, . . . but they also will be better prepared . . . to deal with experts on complex matters [that] take techniques that are all too often excluded from our education."

Values play a major role in policy-making. This means we must reexamine our own values and the value we place on future generations. As we enrich ourselves at the expense of the environment and use up nonrenewable resources, we have to come to understand that we taking from those who come after. We may be destroying the global 'commons' in a manner that is irreversible. It is called the 'sustainability question.'

The concept of **sustainable development** requires finding new paths toward economic and social progress that 'meets the needs of the present without compromising the ability of future generations to meet their own needs.' Changes in the behaviors of individuals, industries, and governments will be needed to allow development and growth that doesn't destroy our natural systems.

It has been said that humankind responds to problems only out of **inspiration** or **desperation**. But, now with the scientific tools and information that we have today, we must also act out of **anticipation**. We must anticipate what could happen and what we want to have happen. We must anticipate what future generations will need for the survival of our species. That is the challenge before us.

## **UPDATE 1995 and On**

### **The Berlin Conference, April 1995**

After the Rio Summit, the UN Intergovernmental Panel on Climate Change continued to sponsor research on the problem of global climate change. This panel is comprised of more than 2,500 scientists from 55 countries. In three working groups, they have theorized, refined computer models, and run scientific experiments. These efforts have determined the likely extent of climate change, of impacts and alternatives, as well as the social, health and economic effects.

With new results, negotiators and scientists met in Berlin in March/April 1995. Officially called the First Conference of the Parties to the Framework Convention on Climate Change, they were there to determine if the goals of the 1992 Rio Summit could be met. Few of the 127 nations that signed the Convention in Rio could say for sure that they could meet the goal of reducing CO<sub>2</sub> emissions to 1990 levels by the year 2000.

The Alliance of Small Island States (AOSIS), a group of 36 nations such as Micronesia that are particularly threatened by rising seas, seized leadership of the climate issue. They asked the delegates to go even further - to reduce carbon dioxide emissions 20% by the year 2005. The Philippines, Malaysia, and Bangladesh joined with the AOSIS, as did India, Brazil, and Egypt. China, which had earlier threatened to walk out, ended up joining them. The reasons were simple. Some of these nations had conducted their own studies showing that their plans for development could be jeopardized by rapid climate change.

The result of the Convention was the so called "Green Paper." During the next two years, diplomats are authorized to negotiate a protocol (a less formal type of treaty) to the Rio climate treaty. They will:

- 1) work out ways to reduce carbon dioxide emissions by at least 20% from the 1990 levels by 2005;
- 2) consider specific measures to accomplish these reductions (reducing fossil fuel subsidies, raising energy taxes, and reducing barriers in the marketplace to energy efficient and renewable energy);
- 3) start pilot projects for technological transfer between countries of less carbon intensive technologies. Wind and solar power, for example, are beginning to boom in Germany, India, Brazil and a number of other nations; and
- 4) finalize an agreement that will be the "Kyoto Protocol." It will be signed at the Third Conference of the Parties in Japan in 1997.

The insurance industry served as a significant lobbying force. Executives from leading European companies such as Munich Reinsurance, Swiss Reinsurance, and Lloyd's of London were there to observe the proceedings. They had suffered tens of billions of dollars of weather-related damages in recent years - \$20 billion alone to Hurricane Andrew in 1992. They had also become concerned by the fact that a growing number of scientists believe that we are already seeing conclusive evidence of climate change.

### **Release of IPCC Report in Rome, December 1995**

Greenhouse warming is now official. The global warming of this century "is unlikely to be entirely due to natural causes," is one of the statements from the Intergovernmental Panel on Climate Change's first full report in five years. It has been 2 years in the making and has involved about 500 scientist authors and another 500 reviewers from more than 70 countries. The United Nations-sponsored IPCC's 1800-page report represents the consensus view of the international scientific community and was presented in Rome to governmental representatives.

Thomas Karl of the National Climatic Data Center in Asheville, NC, who is one of the authors of the Working Group I report, has traced an increase in weather extremes since the mid 1970s that seems to strongly support the greenhouse effect. The evidence suggests that the observed warming "is unlikely to be caused by natural variability," says Karl. "There's a 90 to 95% chance that we're not being fooled...For 99% confidence, we'll have to wait at least another 5 years. (Karr, *SCIENCE*, 9/22/95, p. 1667.)

The bad news is that the sea level has historically risen at a worldwide average of about 3 millimeters per year or .1 inch/yr. Global warming could cause a rise of 1.5 ft. (45 centimeters), possibly a high of 3 2/3 ft. (112 cm.) by the year 2100. (Titus, pp. 135, 144-145). The good news is that this is less rise than estimated earlier by IPCC, and that the warming and its effects could begin to be controlled at a surprisingly low cost. Global warming, however, could affect everything from ocean fisheries to human health, generally for the worse.

The world could warm between 1° and 3.5°C by the year 2100. The exact figures depend on how much CO<sub>2</sub> and other greenhouse gases humankind pumps into the atmosphere and how sensitive climate is to the added greenhouse gases. The new upper limit of warming is lower than the 5°C the IPCC had forecast 3 years ago in an interim report, largely because of the newly appreciated cooling effect of pollutant aerosols discussed later in this section. But, a warming near the upper limit of the new range could still have a dramatic impact. These are a sample of the kind of projections being made:

- **Agriculture.** Agricultural areas will move north as climate zones shift. Climate change will modify rainfall, evaporation rates, runoff, and soil moisture. With drier conditions, more water will be required per acre. Increased competition for water between agriculture and urban as well as industrial users will drive water prices up. Water tables will be lowered making irrigation more expensive or even impossible. For example, the Ogallala aquifer (including parts of Nebraska, Oklahoma, Texas, Colorado, and New Mexico) may be taken out of irrigation. There could be an increased hazard of salt accumulation in the soil, from intensified evaporation. Spells of intense heat could be particularly harmful where certain varieties of crops are grown near their limits of maximum temperature tolerance. For example, rice in Southern Asia.
- **Climate Extremes.** Possible changes in the climate could result in increasing disruptive weather -- spells of high temperatures, heavy storms, floods, record-breaking droughts, cyclones, and hurricanes, all of which disrupt crop production. However, the effects of increased coastal flooding and land losses on low-lying coasts could be lessened with the right technology.
- **Forests.** Mid-latitude climate zones would shift north by 550 kilometers (330 miles) over the next century. At that rate, some species of trees might not be able to keep up and would simply die out along with the animal life. In eastern North America, the panel says, a high-end warming would wipe out much of the eastern hardwood forest, opening the way for grassland and scrubland.

Coniferous, boreal (northern) forests account for about a third of the world's total forest area. Canada, Alaska, and Scandinavia all contain tracts of boreal forest with 73% in Russia. They play a crucial role in regulating global climate by absorbing large amounts of CO<sub>2</sub> that would otherwise contribute to global warming. More carbon may be locked up in the boreal forest than in any other terrestrial ecological system. The boreal forest is believed to be especially sensitive to climate change. Drier weather could upset the hydrological balance of the widespread bogs, and increase the incidence of fires. Warmer temperatures could open up areas to southern pests or to expanding temperate forests which could displace native plant communities.

- **Biodiversity.** Humankind has identified only 1.4 million species of the estimated 5 million, perhaps as many as 100 million species, on Earth. Global warming will have inestimable effect on species that are already endangered and even those that are thriving. Some can adapt as habitat shifts with the climate zone shifts. Many cannot, and will not. As an environmentalist once said, "With the loss of these species, we will have lost answers to questions we don't even know enough to ask."
- **Human Health.** At the high end of the projected temperature rises of 3° to 5°C., warming looks disturbing to health. Experts say that such temperature could spread sub-tropical and tropical areas, leading to increased insect carriers. By late next century, there could be a 7% to 15% increase in diseases such as malaria, dengue, yellow fever, viral encephalitis, etc. These diseases could spread to more temperate latitudes and into areas that are currently too dry for them. (Wilken, *WORLDWATCH*)

Estimates are for large number of deaths due to high summer temperatures. For example, in New York City, which has the record high of heat-related deaths, there could be an increase from 320 per summer to at least 880. Numbers would be much higher in third world cities where air conditioning is not available to most of the population. (Stone, p. 958)

- **The Economics of Adapting to Global Warming.** The U.S. faces costly adaptation, but it wouldn't wreck our economy. Developing countries will suffer the most from any effect of global warming. They lack large social and economic resources to adapt. They are servicing debt payments through 15 to 19% of their export revenues. However, some developing countries have had debts refinanced on terms more favorable to them. Some 80%, owed to commercial banks, has been restructured. Restructuring means that commercial banks or private lenders are picking up the debt, such as for Brazil. But, the poorest nations have yet to see much relief. Debt-for-equity swaps accounted for 36% of all debt conversions, but nations are forced to part with their assets such as steel mills or a telephone companies. Debt-for-nature and debt-for-development account for only 2% of conversion of debt. The ability of developing countries to adapt is not presently feasible. (Gardner, *WORLDWATCH*)

### **1996 and Beyond: A Few of the Areas Under Study**

**"Dead Zones."** In 1995, it was reported that a rising temperature in the sea off the coast of Southern California had killed off large percentages of microscopic animals, called zooplankton. Zooplankton makes up the major food source for many fish and bird species. This huge "dead zone" has been created in a locale that was once a flourishing marine habitat. A 2 to 3° degree increase in water temperatures, as far down as 100 fathoms, showed a decline in zooplankton. These warmer waters were reducing the nitrate and phosphate nutrients that nourish the tiny plants upon which the zooplankton feed. It is being studied.

**Seasonal Change.** In a study of patterns of seasonal change over time, it was discovered that in the middle of the 20th century, the delay in arrival of the seasons started to become more pronounced. From the mid 1600's until around 1945, winter arrived on an average 1.4 days later each century. This was considered to be a normal result of a combination of the earth's rotation and its orbital positions. Yet, the seasons have been delayed 4.5 days in the last 50 years, as much as in the past 300 years combined. A strong link exists between this change of seasons and the increase in atmospheric carbon dioxide, 'a greenhouse gas.'

### **Warming of Antarctica.**

Nearly 400 square miles of the Larsen Ice Shelf in the Antarctic broke off in March 1995. It exposed rocks that had been buried for 20,000 years. Rodolfo del Valle of the Argentine Antarctic Institute told the Associated Press, "Last November [1994], we predicted the [ice shelf] would crack in ten years, but it has happened in barely two months." (Gelbspan, p. 31)

**El Niño.** Antarctica is warming, there is a shift in the timing of seasons and an increase in the severity of winter storms in northern Europe. All suggest that these irregularities may be the "fingerprint" of climate change. In addition, there is an increased frequency of *El Niño*, (Spanish for "Christ Child"), which usually occurs every 3 to 5 years around Christmas time and lasts 12 to 18 months. The current *El Niño*, however, has already lasted five years, breaking the previous record of four years. Scientists are studying these phenomena because they represent a distinct trend, and not just an abnormality. The trend toward more frequent *El Niño* events since the late 1970s raises major questions about climate change. (Archarya, J/Aug 1995.)

**The Role of Clouds.** Clouds are complex systems, and the physics of clouds are not fully understood. The usual thinking has been that clouds reflect some of the solar radiation entering the atmosphere, but do not absorb any more radiation than a clear sky would. It now appears that clouds may be absorbing a considerable amount of solar radiation, thus impacting climate. (Levi, pp.21-23.)

#### **Sulfate Aerosols.**

Sulfate aerosols, one type of aerosol, are small solid particles or droplets that result from the burning of fossil fuels or the smelting of ores. Fossil fuels contain sulfur. When burned, they release sulfur dioxide into the atmosphere. There, a complicated chemical reaction changes them into sulfate aerosols. Too small to fall very rapidly, the sulfate aerosols hang around in the atmosphere and reflect some of the solar radiation back into space. This prevents some sunlight from reaching the earth, thus reducing the effect of the greenhouse gases. But, it doesn't explain why observed night time temperatures go up as much as they do when daytime temperatures are down. What is now being studied is the role of sulfate aerosols in cloud formation. These sulfate aerosols serve as nuclei for cloud condensation. By increasing the number of small droplets, aerosols indirectly increase the lifetime of individual clouds, thereby increasing cloudiness. Cloudier skies reduce the solar radiation by day but hold in the heat at night. (Harvey, pp. 15-16)

**Forests.** Measurements were taken of carbon dioxide change over undisturbed tropical rain forest in Brazil for 55 days in the wet and dry seasons of 1992-1993. They showed that this ecosystem absorbs significant amounts of carbon dioxide. Most of the world's tropical forests are mature and undisturbed, and little is known about their carbon balance. (Grace, pp. 778-780.) Forests once covered more than 40% of Earth's land surface, but that expanse has been reduced by one-third. Tropical forests have lost half their original extensive area in the last 50 years, the most rapid decline since 1950. This represents the fastest vegetation change in human history. Temperate forests are in a steady state, but boreal forests are undergoing far-reaching depletion in Siberia. Acid rain is damaging boreal forest in northeastern North America and in central Europe. All forests constitute carbon sinks. They take up carbon from the atmosphere.

A new policy approach toward forests is needed. Studies are showing why forests should be promoted as *global commons* resources because they benefit not just the forest nation, but the entire global community. Issues are being raised as to national rights and the international responsibility of forest nations. The value of the ecological services that forests provide reach far beyond national boundaries because of their watershed basins, atmospheric processes, and climate systems. **"The winds carry no passports."** (Myers, pp. 823-824)

There are many more areas of study to enable our global community to understand what is happening to our Planet Earth. Hopefully, you now have enough information to at least follow the discussion on global climate change and enter into the public debate, to ask the right questions of the experts, and to perhaps even make a difference. As Margaret Meade said, "Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has."

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GLOBAL CLIMATE CHANGE



GREENHOUSE GASES



STANDARD OF LIVING

PER CAPITA ENERGY CONSUMPTION

Affects

as measured by

Per Capita GNP

CONSUMPTION

Affects

Affects

POPULATION GROWTH

(Population Density)

(% Urban)

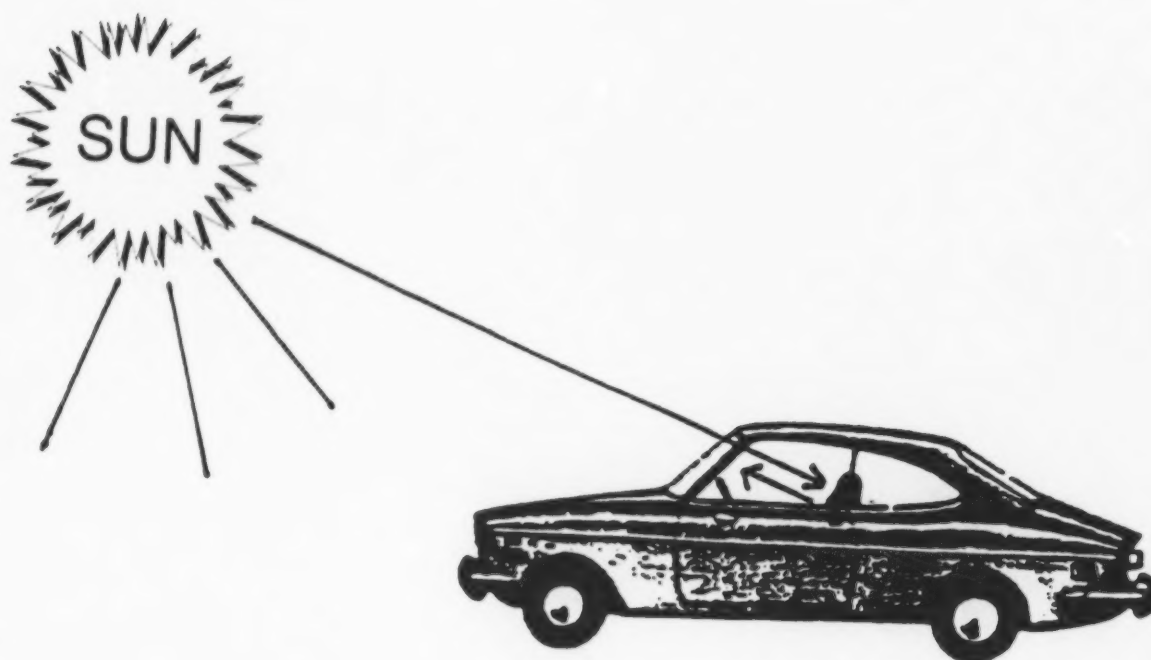
(Doubling Time)

(Population Under Age 15)

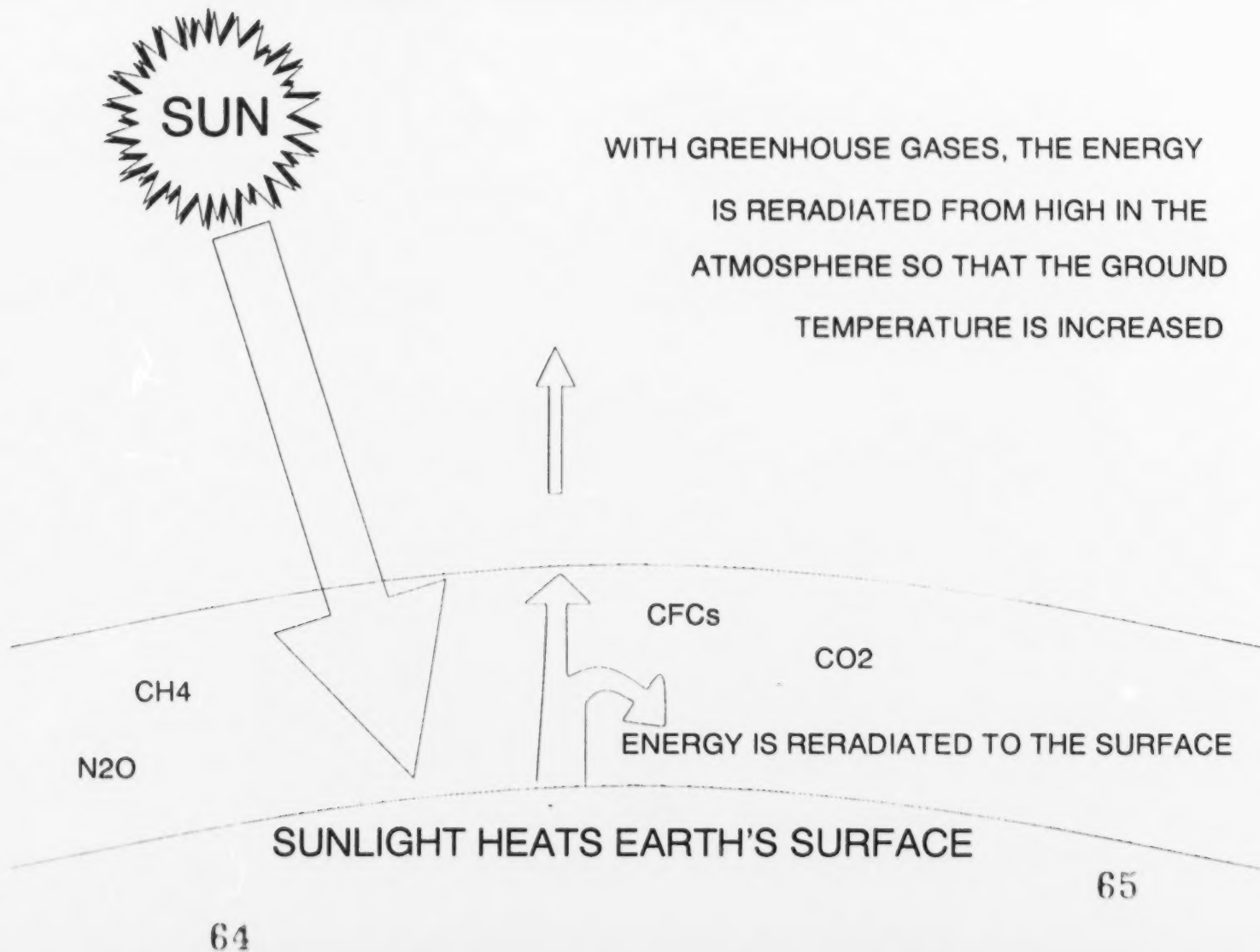
61

62

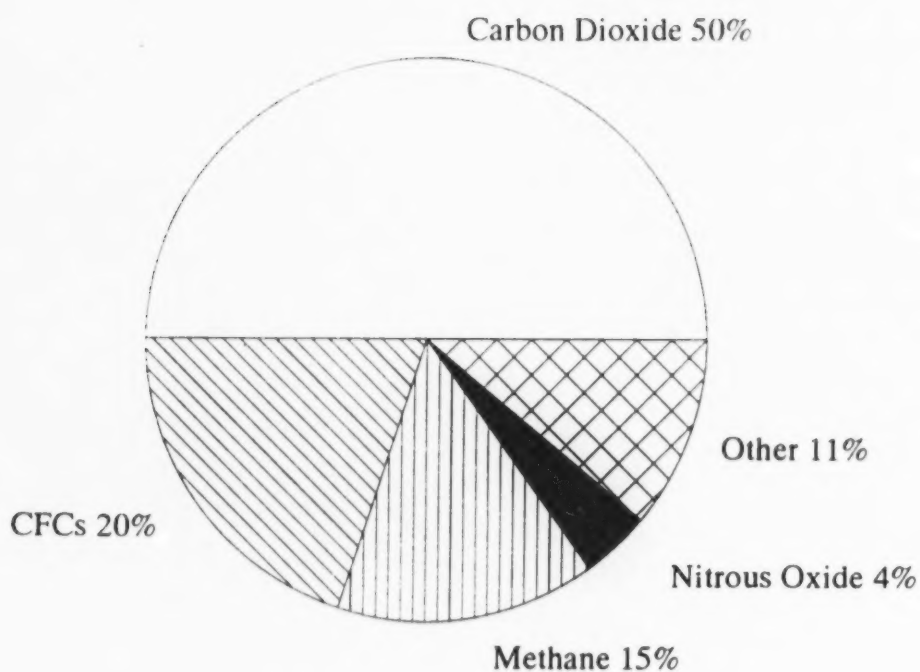
# GREENHOUSE EFFECT



# GREENHOUSE EFFECT

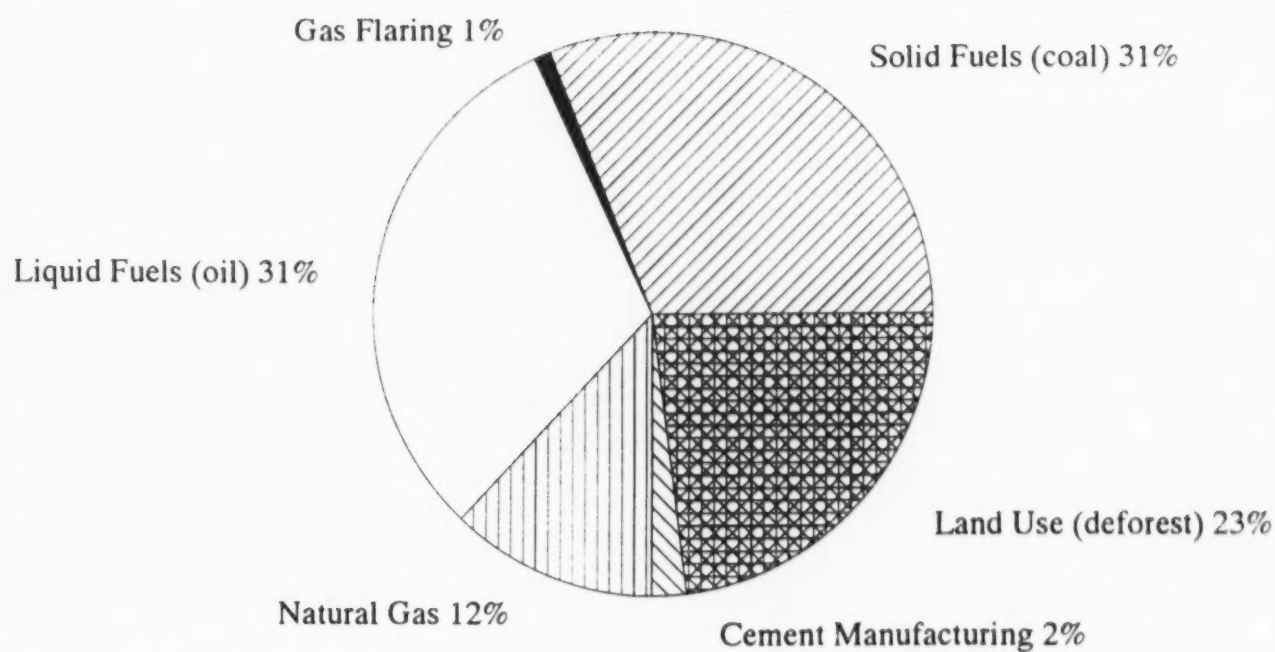


## GREENHOUSE GASES FROM HUMAN ACTIVITIES



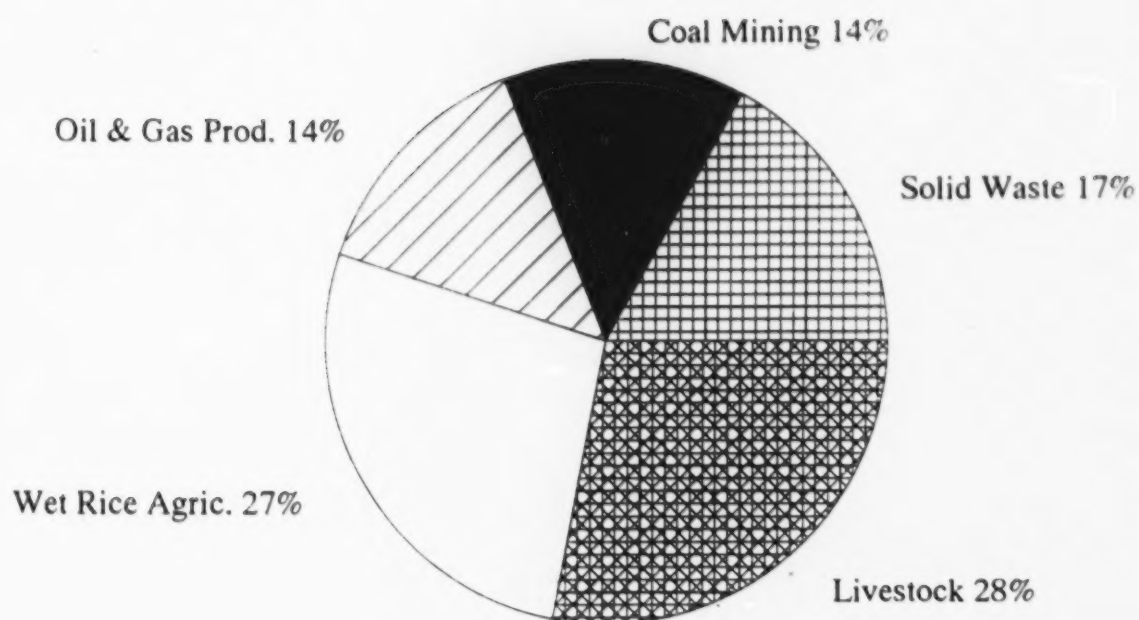
Source: Journal of Air Waste Manage.  
Assoc., Vol. 40, March 1990, p. 292

## SOURCES OF CARBON DIOXIDE FROM HUMAN ACTIVITIES

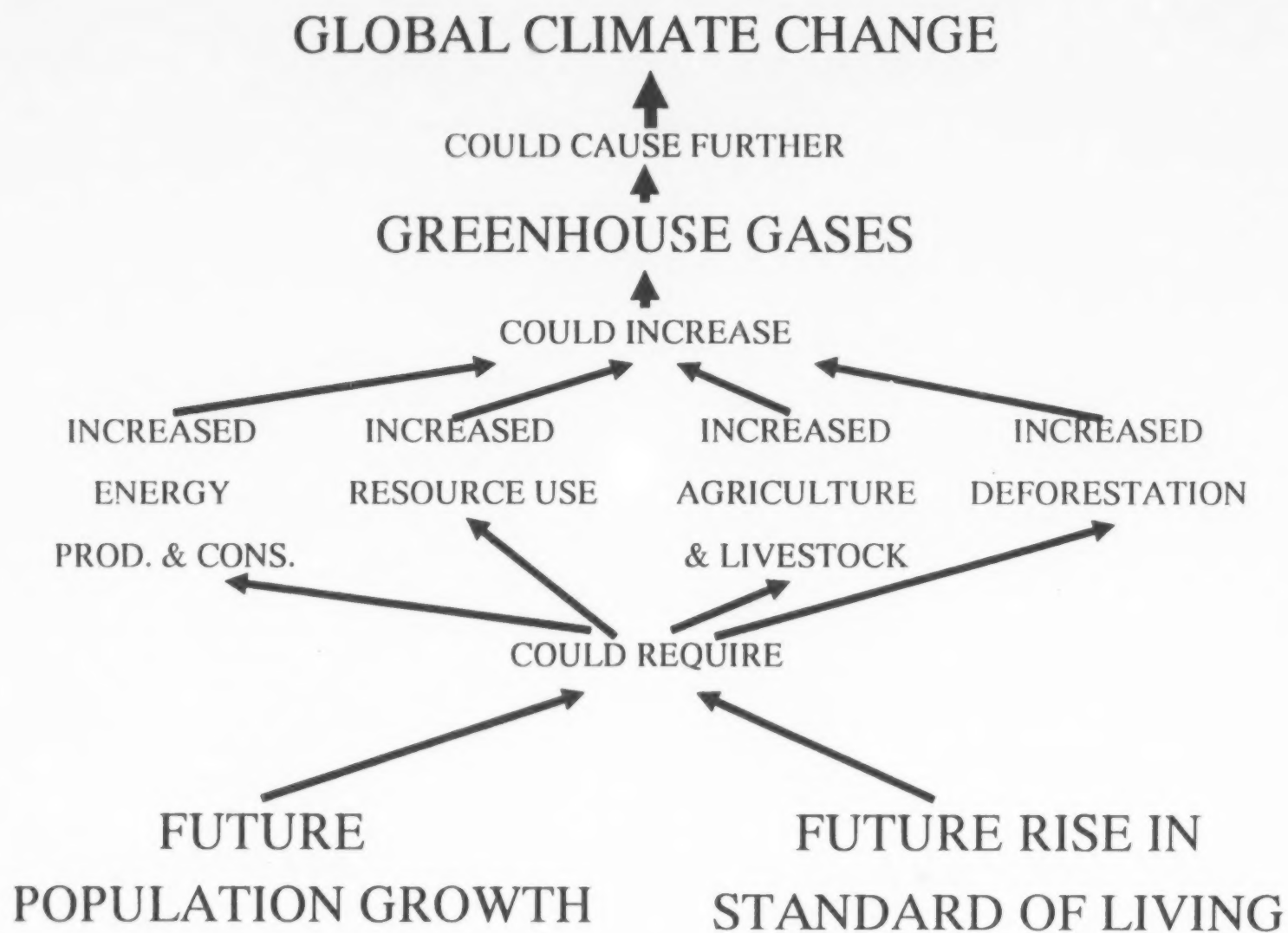


Source: WORLD RESOURCES 1992-93  
pp. 348-350

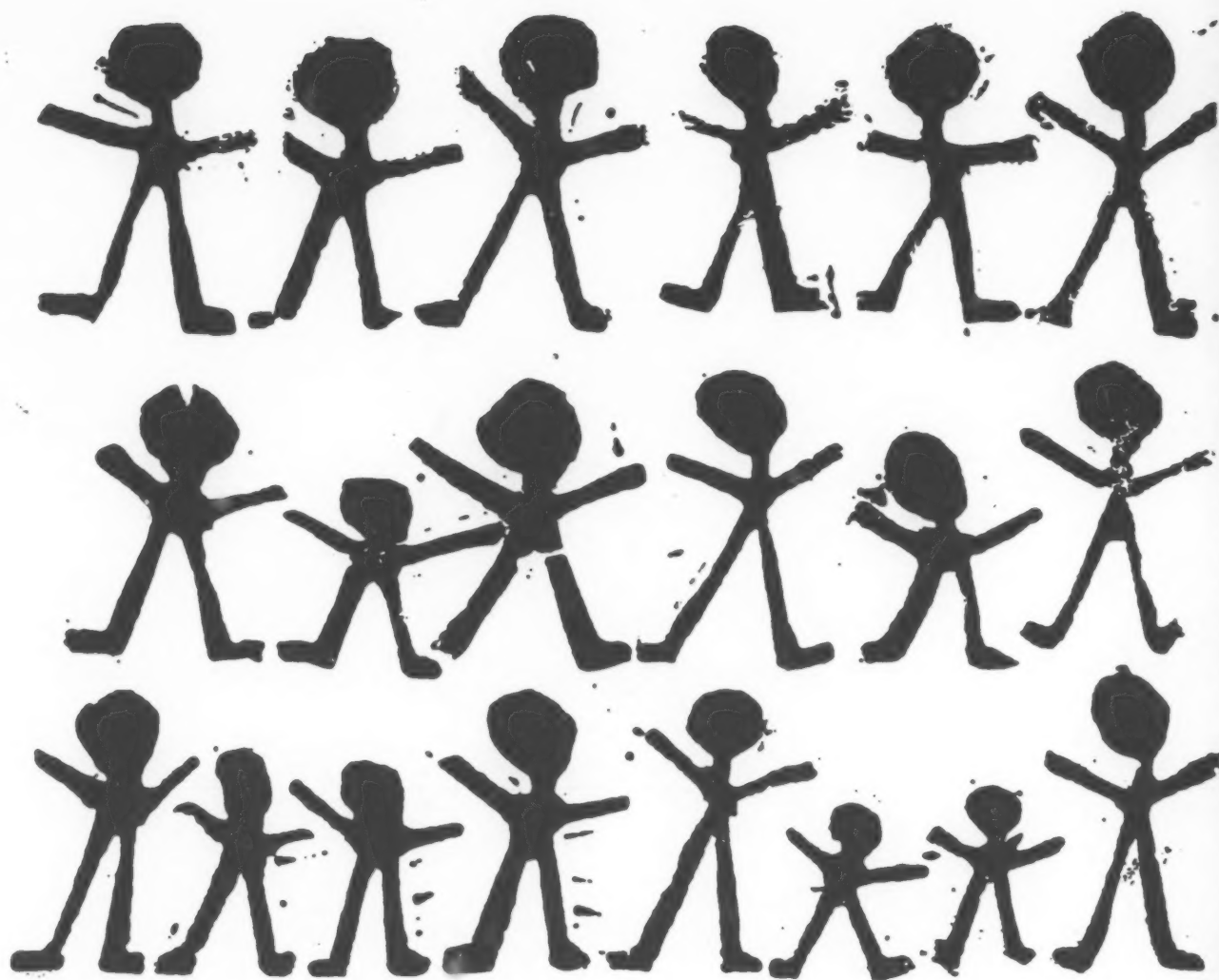
## SOURCES OF METHANE FROM HUMAN ACTIVITIES



Source: WORLD RESOURCES 1992-93, p. 348

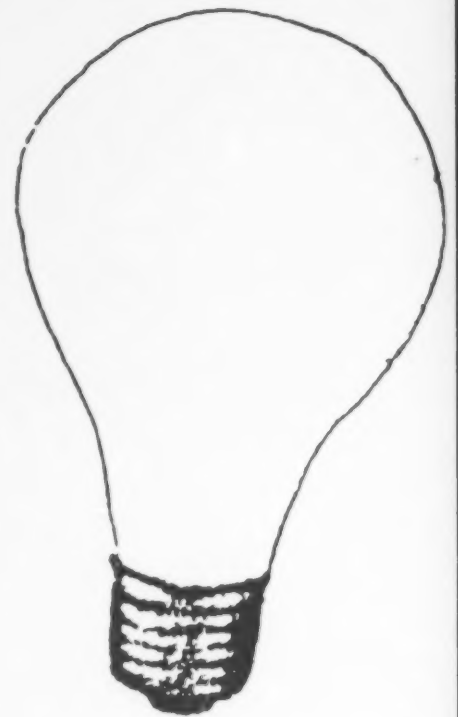


Population Fold-Out Cards (pg. ii)  
Game Component for 'What's In It For Me?'



Per Capita Energy Consumption - 1 metric ton (p. iii)  
Game Component for 'What's In It For Me?'

Pattern for Duplication



Per Capita Energy Consumption - 1 metric ton (p. iii)  
Game Component for 'What's In It For Me?'

Pattern for Duplication



1/2



1/3



1/4



1/7